5-4520-240-14

TM 5-4520-240-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL

HEATER, SPACE, MULTIFUEL, WITH BLOWER,
15,000 BTU/HR, 28 VDC
(HUNTER MODEL UH-48-C, TYPE IV)
NSN 4520-01-010-4059

This copy is a reprint which includes current pages from Changes 1 through 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY

August 1976

READEX FICHE best copy available

WARNING

SHOCK HAZARD

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always disconnect the power plug before making any continuity tests or before repairing the heater.

POISONOUS GAS HAZARD

Do not operate this heater in an enclosed area unless exhaust gases are piped to the outside. Do not locate the heater where expelled exhaust gases can be recirculated into inlet air openings of the heated space. The exhaust gases may contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Inhalation of exhaust fumes can cause serious illness or death. Stop heater operation and check exhaust connections if exhaust gas odors are apparent in the enclosure.

HEALTH HAZARD

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

DEATH

or serious illness may result from inhalation of exhaust fumes. The heat exchanger confines the combustion gases and directs them to the exhaust pipe. It must be air tight to prevent harmful combustion products from entering the heated enclosure. Any crack or hole through the exchanger walls requires exchanger replacement.

TM 5-4520-240-14
C 3

CHANGE
No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 12 February 1987

Operator, Organizational, Direct Support and
General Support Maintenance Manual

HEATER, SPACE, MULTIFUEL, WITH BLOWER,
15,000 BTU/HR, 28VDC
(HUNTER MODELS UH-48-C AND UH-48-D, TYPE IV)
(NSN 4520-01-010-4059 AND NSN 4520-01-069-6959)

TM 5-4520-240-14, 28 August 1976, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
4-3 and 4-4	4-3 and 4-4

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Organizational, Direct Support and General Support Maintenance requirements for Heater, Space, Multifuel, 28V, DC, 15,000 BTU (UN-48C, UH-48D-Type IV).

TM 5-4520-240-14
C2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C, 1 April 1986

Operator, Organizational, Direct Support and
General Support Maintenance Manual

HEATER, SPACE, MULTIFUEL, WITH BLOWER,
15,000 BTU/HR, 28VDC
(HUNTER MODELS UH-48-C AND UH-48-D, TYPE IV)
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Remove pages	Insert pages
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
3-1 and 3-2	3-1 and 3-2
4-3 and 4-4	4-3 and 4-4
A-1 /A-2	A-1/A-2
1-5 and 1-6	1-5 and 1-6

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TM 5-4520-240-14
C 1

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 July 1981

OPERATOR, ORGANIZATIONAL DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL

HEATER, SPACE, MULTIFUEL, WITH BLOWER,
15,000 BTU/HR, 28V DC
(HUNTER MODELS UH-48-C AND UH-48-D, TYPE IV)
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1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Table of Contents	i and ii	i and ii
Chapter 1	1-1 thru 1-6	1-1 thru 1-6
Chapter 4	4-23	4-23/4-24
Index	I-1 and I-2	I-1 and I-2

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General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

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TECHNICAL MANUAL
No. 5-4520-240-14

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *28 August 1976*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

HEATER, SPACE, MULTIFUEL, WITH BLOWER, 15,000 BTU/HR, 28V DC (HUNTER MODELS UH-48-C AND UH-48-D, TYPE IV) (NSN 4520-01-010-4059 AND NSN 4520-01-069-6959)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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10-3	Burner head, heat exchanger, and blower installation, exploded view
10-4	Blower assembly, exploded view

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope.

This manual is for your use while operating and maintaining Heater, Space, Multifuel, with Blower, 15,000 BTU/HR, 28VDC, Model UH-48-C and UH-48-D,Type IV.

1-2. Maintenance Forms and Records.

a. Maintenance forms and records that you are required to use are as follows:

(1) DA Form 2402 (Exchange Tag).

(2) DA Form 2404 (Equipment Inspection and Worksheet).

(3) DA Form 2407 (Maintenance Request Used for Requesting Support Maintenance).

(4) DA Form 2407-1 (Continuation Sheet Used for Requesting Support Maintenance).

b. For additional forms and records pertaining to your particular equipment, refer to DA PAM 738-750 (The Army Maintenance Management System (TAMMS)).

1-3. Equipment Serviceability Criteria.

This equipment is not covered by an ESC.

1-4. Destruction of Army Materiel to Prevent Enemy Use.

a. Destruction by Misuse.

(1) Pour sand and gravel into the fuel supply.

(2) Block air inlet and outlet passages with oil-soaked rags or debris.

b. Mechanical Destruction. Using an axe, pick, mattock, sledge, or any other heavy implement, damage all vital elements such as controls, fuel pump, switches and valves, motor and any other major assemblies and components.

c. Destruction by Fire. Pour fuel over unit and pile quantities of flammable material around unit. Burn assemblies and components on a priority basis if possible. Proper concentration of equipment to be burned will produce a hotter, more destructive fire. Fires should be lit after mechanical destruction has been accomplished.

d. Destruction by Gunfire. Fire on the equipment with the heaviest weapons available, aiming at the major assemblies and controls.

WARNING

Point blank firing at equipment should not be attempted unless the safety of all personnel in the area is assured.

e. Use of Natural Surroundings.

(1) Submergence of equipment and repair parts underwater (lakes, ponds, bogs, swamps, etc.), or by concealment by hiding material in caves or preferably by burial, can be used effectively.

(2) Widely dispersed scattering of material, preferably into heavy underbrush, can serve as a denial or delaying measure. In the event the area is recaptured, effort should be made to recoup concealed items.

1-5. Administrative Storage.

a. General.

(1) Equipment that is placed in administrative storage should be capable of being readied to perform its mission within a 24-hour period or as otherwise may be prescribed by the approving authority.

(2) Report equipment in administrative storage in Materiel Readiness and Unit Readiness reports as prescribed for all reportable equipment.

(3) Perform inspections, maintenance services, and lubrications in accordance with the instructions in this manual.

b. Storage Site.

(1) Select the best available site for storage. Separate stored equipment from equipment in use. Conspicuously mark the area "Administrative Storage".

(2) Covered space is preferred. Open sites should be improved hardstand, if available. Unimproved sites should be firm, well-drained, and kept free of excessive vegetation.

c. Storage Plan.

(1) Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance, and exercising.

(2) Take into account environmental conditions, such as extreme heat or cold; high humidity; blowing sand, dust, or loose debris; soft ground; and take adequate precautions.

d. Maintenance Services and Inspection.

(1) Prior to storage, perform the next scheduled major preventive maintenance checks and services. Inspect and approve equipment.

(2) Correct all shortcomings and deficiencies. Clean the equipment of dirt, grease, and other contaminants.

(3) Remove rust and damaged paint by scraping, wire brushing, sanding, or buffing. Sand to a smooth finish and spot paint as necessary.

(4) After cleaning and drying, immediately coat unpainted surfaces with an oil or grease as appropriate.

(5) Install all covers; close and secure all openings except those required for venting and draining. Seal openings to prevent entry of rain, snow, or dust. Place equipment and provide adequate blocking to allow for draining of water. Refer to TM 740-90-1 for any additional instructions.

Section II. DESCRIPTION AND DATA

1-6. Description.

a. The Models UH-48-C and UH-48-D, Type IV, Multifuel Space Heater is designed for heating enclosures at which a source of 28-volt direct current power is available. It has a maximum output of 15,000 Btu per hour, and is desinged for floor or wall installation. The heater is controlled by a remotely mounted thermostat to maintain a selected temperature in an enclosed space within the range of 35° to 95°F (1.7° to 35°C) up to the rated output of the heater.

b. The heater is equipped with a removable discharge louver for directing the outlet air. A screened air inlet opening provides for entry of circulating air. Combustion air is provided by a separate impeller assembly and enters the heater through an opening at the rea the heater.

c. The heater is equipped with a timed ignition c trol for safe thermostat-controlled starting with continuous operator supervision. A safety control shut off the power if ignition does not occur withi preset time, minimizing risk of fire or explosion protecting the unit from damage in the event of equ ment malfunction or loss of fuel supply.

d. Once the heater is in full operation, an additio safety control will shut off the flow of fuel if the u reaches a preset overheat temperature.

e. The maintenance paragraphs of this manual c tain detailed descriptions of heater componenta.

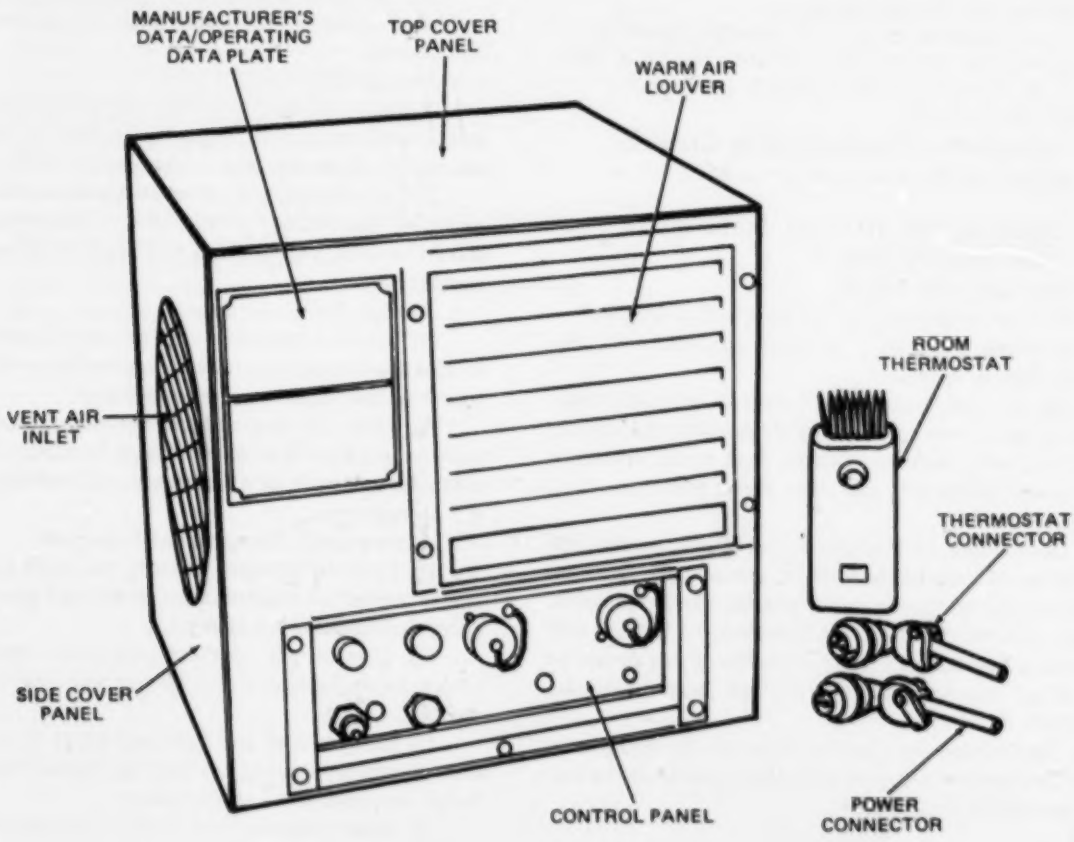


Figure 1-1. Multifuel Space Heater, Left Front, Three-Quarter View.

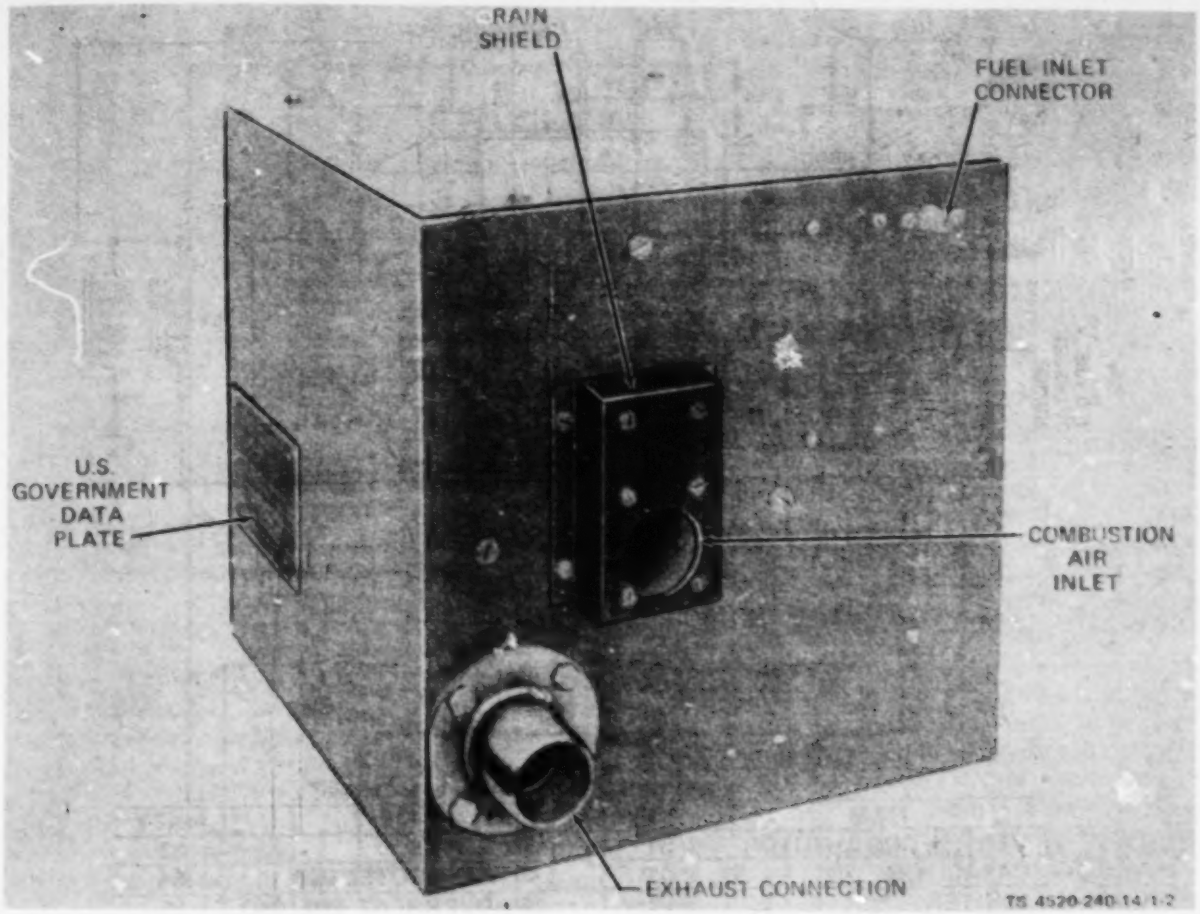


Figure 1-2. Multifuel space heater, right rear, three-quarter view.

1-7. Identification and Tabulated Data.

a. Identification. The heater has three major identification plates, as follows:

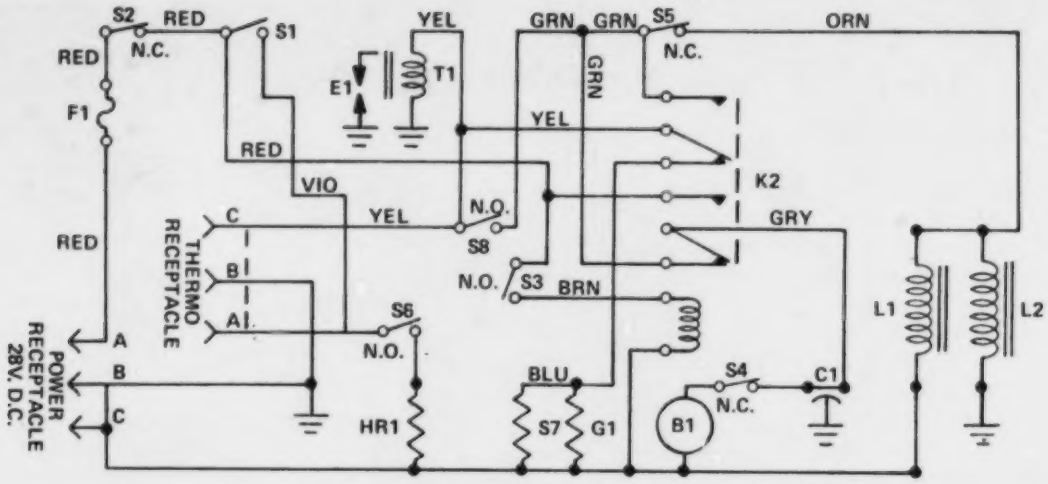
(1) The manufacturer's data/operating data plate (fig. 1-1) lists information regarding the model, output, electrical requirements, serial number, and manufacturer's name and location. It also provides brief operating instructions.

(2) The U.S. Government data plate provides the nomenclature, national stock number, part number, manufacturer, contract number, date, serial number, and weight.

(3) The wiring diagram plate is mounted on the inside of the top cover panel of the heater. This plate shows an electrical schematic and a wiring diagram for the heater.

b. Tabulated Data. Tabulated data applicable to the space heater and its components is given in table 1-1.

c. Electrical Schematic and Wiring Diagram. Refer to figure 1-3 for the electrical schematic diagram. Refer to figure 1-4 for the electrical wiring diagram.

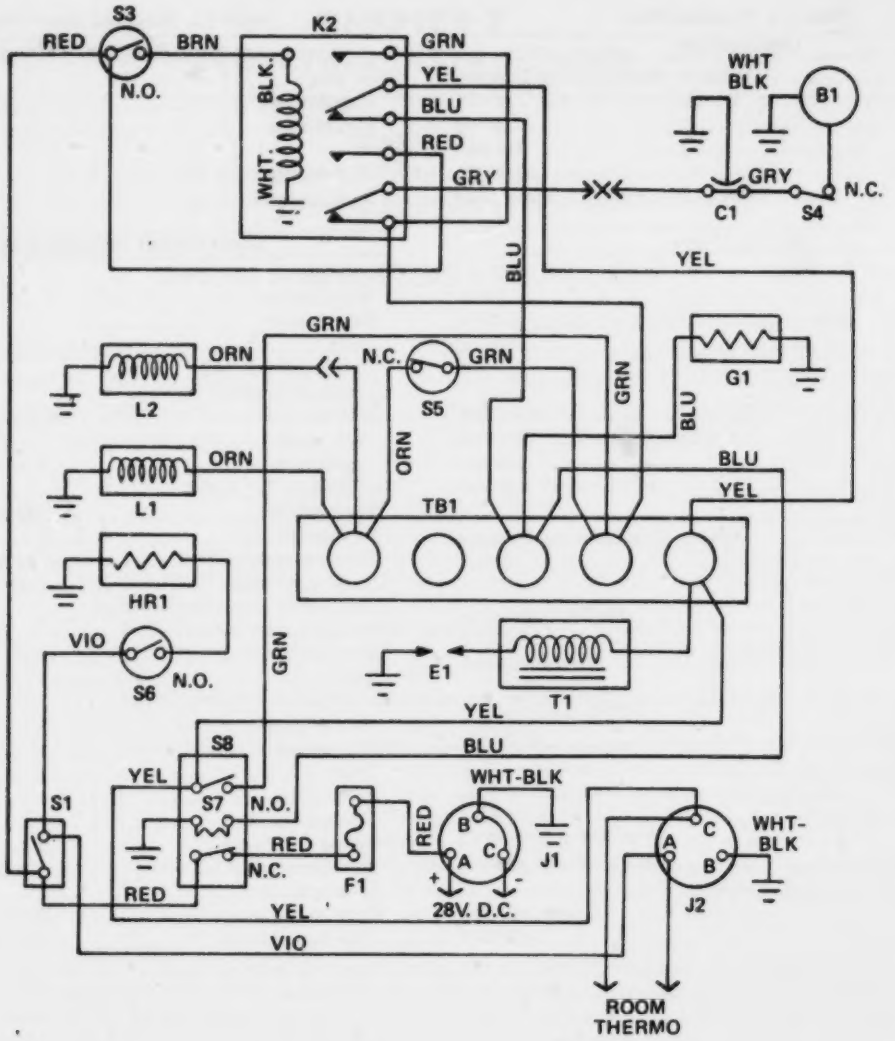


KEY TO DIAGRAM

ITEM	KEY	ITEM	KEY
VENT. & COMB. MOTOR	B1	SW-FLAME	S3
CAPACITOR	C1	MOTOR PROTECTOR	S4
IGNITER	E1	SW-OVERHEAT THERMO	S5
FUSE	F1	SW-FUEL THERMO	S6
GLOW PLUG	G1	TIMER-HEATER	S7
VALVE-SOLENOID	L1	SW-DELAY	S8
FUEL PUMP-NEG. GRD.	L2	IGNITION-TRANSISTOR	T1
SW. ON-OFF SPST	S1	HEATER-FUEL BLOCK	HR1
HEATER-RESET SW.	S2	RELAY-DPDT	K2

TS 4520-240-14/1-3

Figure 1-3. Electrical schematic diagram.



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FUSE	F1	SW-FUEL THERMO	S6
GLOW PLUG	G1	TIMER-HEATER	S7
RECEPTACLE-POWER	J1	SW-DELAY	S8
RECEPTACLE-THERMO	J2	IGNITION-TRANSISTOR	T1
VALVE-SOLENOID	L1	HEATER-FUEL BLOCK	HR1
FUEL PUMP-NEG. GRD.	L2	TERMINAL BLOCK	TB1
SW. ON-OFF SPST	S1	RELAY-DPDT	K2
HEATER-RESET SW.	S2		

TS 4520-240-14/1-4

Figure 1-4. Electrical wiring diagram.

Table 1-1. Tabulated Data

OPERATOR/CREW

Manufacturer ..... Hunter Manufacturing Company
Model number ..... UH-48-C and UH-48-D, Type IV
Volts ..... 28 vdc
Watts ..... 346 max
Btu output 15,000
Description ..... Heater, space, multifuel, with blower

ORGANIZATIONAL

Overall dimensions and weight
- Height ..... 12 in.
- Width ..... 12 in.
- Depth ..... 13-⅛ in.
- Weight ..... 40 lb

Fuel pump
- Manufacturer ..... Conelec, Inc.
- Part number C-106091
- Type ..... Electric
- Voltage ..... 24 vdc, negative ground

Fuel float bowl
- Manufacturer ..... Tillotson Manufacturing Company
- Part number 013440

Fuel strainer
- Manufacturer ..... Bendix Corporation
- Part number F499-5-3
- Type ..... Strainer element

Thermocouple
- Manufacturer ..... ITT General Controls
- Catalog number ..... G 251A13

Room thermostat
- Manufacturer ..... Penn Controls, Inc.
- Part number A19BAB-3
- Range ..... 35° to 95°F (1.7° to 35°C)
- Pilot duty rating ..... 125 volt-amperes

Igniter
- Manufacturer ..... Hunter Mfg. Co.
- Part number 2-48174-02

Table 1-1. Tabulated Data—Continued

ORGANIZATIONAL — continued

Glow plug
- Manufacturer ..... Hunter Mfg. Co.
- Part Number 48862-02

Fuse
- Manufacturer ..... Littlefuse, Inc.
- Part number 307020

DIRECT SUPPORT AND GENERAL SUPPORT

Blower motor
- Manufacturer ..... Universal Electric Co.
- Part number YZ1U020K
- Volts ..... 28 vdc
- Rated rpm, full load ..... 4600 ± 200 rpm

Suppression capacitor (motor)
- Manufacturer ..... Cornell-Dubilier Electric Corp.
- Part number ..... NFT 2H47402TA
- Capacitance ..... 0.47 μF, 200 vdc, 10 amps

Fuel preheat thermostat
- Manufacturer ..... Essex International, Inc.
- Catalog number 110047
- Open temperature ..... 55° ± 6°F (9.4° to 16.1°C)
- Close temperature ..... 40° ± 6°F (1.1° to 7.8°C)

Thermocouple relay (flame switch)
- Manufacturer ..... ITT General Controls
- Part number A100YA2A
- Type ..... SPDT

Control relay
- Manufacturer ..... Hunter Mfg. Co.
- Part number 5873
- Type ..... DPDT type 1
- Duty rating ..... Continuous
- Electrical rating ..... 10 amperes

Overheat thermostat
- Manufacturer ..... Essex International, Inc.
- Catalog number A-542
- Open on rise temperature ..... 250° ± 6°F (118° to 124°C)
- Close temperature ..... 210° ± 12°F (92° to 105°C)

CHAPTER 2
OPERATING INSTRUCTIONS

WARNING

If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

Section I. OPERATING PROCEDURES

2-1. General.

This section contains information and instructions for the personnel responsible for operating this space heater. The information includes starting and stopping procedures, and basic heater operation.

2-2. Controls and Instruments.

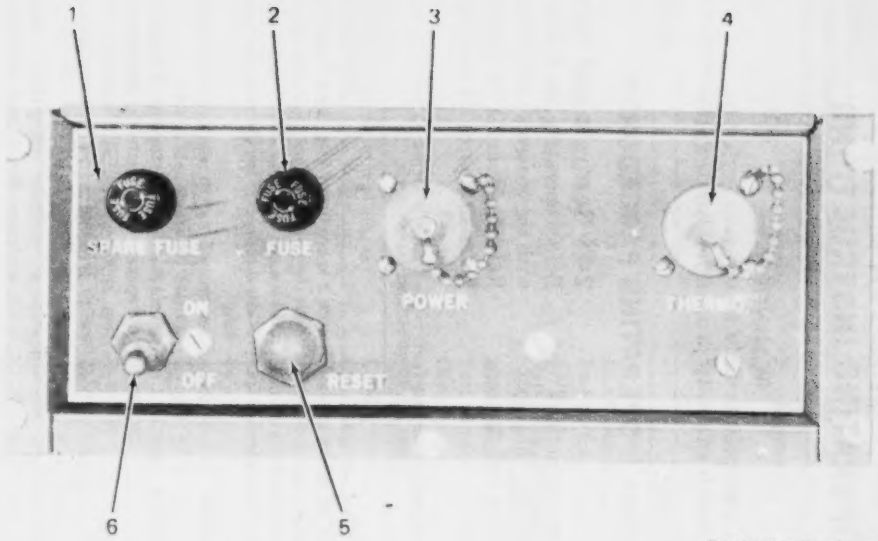
Before operating the heater, you must become familiar with the controls and instruments provided on the unit. Refer to table 2-1 for a description of control features. Refer to figures 2-1 and 2-2.

Table 2-1. Controls and Instruments

Figure and item number		Name	Operation and use
2-1	1	SPARE FUSE holder	Houses a spare fuse which can be used if the in-circuit fuse blows out.
2-1	2	FUSE holder	Houses the in-circuit fuse to protect electrical circuits from overload.
2-1	3	POWER receptacle	Provides a connector for 28-volt direct current input to the heater.
2-1	4	THERMO receptacle	Provides a connector for the room thermostat which controls heater operation.
2-1	5	RESET switch	When pressed, switch resets heater circuits after heater has stopped due to ignition failure or lack of fuel.
2-1	6	ON-OFF switch	Controls starting and stopping of heater. In ON position, heater will start and operate under control of room thermostat. When placed in OFF position, switch stops heater operation. If motor blower is running when switch is moved to OFF, heater will continue to run until cool, then shut off.
2-2		Thermostat knob	Provides a means of selecting the temperature which heater is to maintain in the enclosure. Rotate knob until desired temperature is aligned with index mark.

NOTE

The thermostat provides only an on-off control of the heater. Raising the thermostat setting does not increase the heat output of the heater per unit of operating time. It merely causes the heater to run longer to satisfy the heat demand. Setting the thermostat to the highest setting at startup does not increase the rate at which the desired temperature will be reached. To prevent temperature overshoot, set the thermostat only to the temperature desired for the enclosure.



1. Spare fuse holder
2. Fuse holder
3. Power receptacle
4. Thermo receptacle
5. Reset switch
6. On-off switch

Figure 2-1. Heater controls and connectors.

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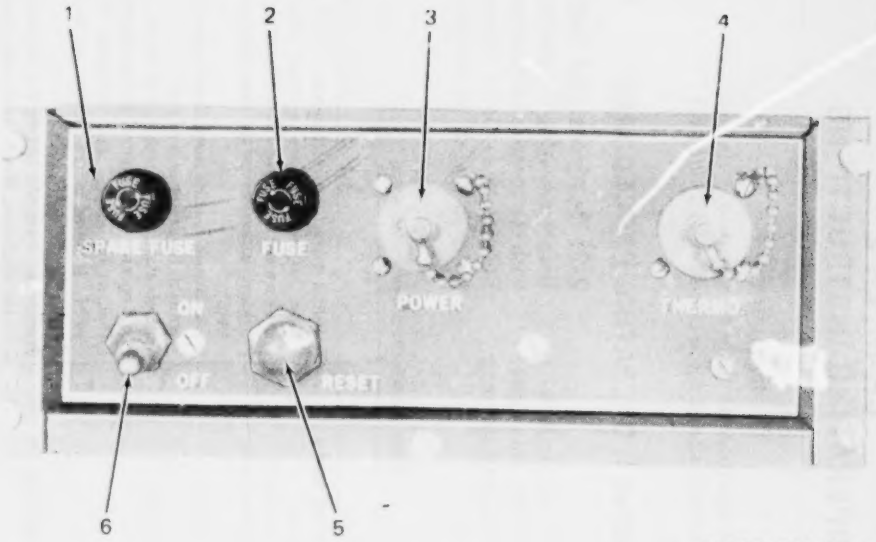

1. Spare fuse holder
2. Fuse holder
3. Power receptacle
4. Thermo receptacle
5. Reset switch
6. On-off switch

Figure 2-1. Heater controls and connectors.

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This section contains information and instructions for the personnel responsible for operating this space heater. The information includes starting and stopping procedures, and basic heater operation.

2-2. Controls and Instruments.

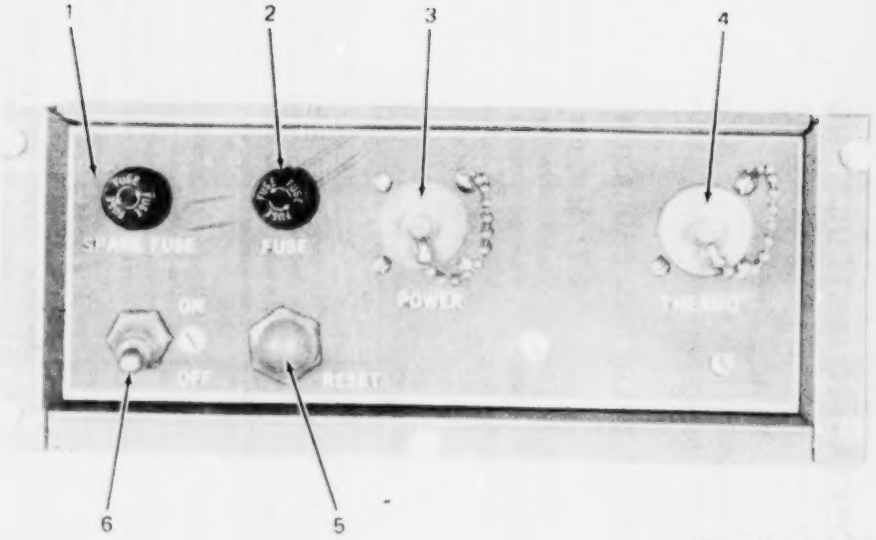
Before operating the heater, you must become familiar with the controls and instruments provided on the unit. Refer to table 2-1 for a description of control features. Refer to figures 2-1 and 2-2.

Table 2-1. Controls and Instruments

Figure and item number		Name	Operation and use
2-1	1	SPARE FUSE holder	Houses a spare fuse which can be used if the in-circuit fuse blows out.
2-1	2	FUSE holder	Houses the in-circuit fuse to protect electrical circuits from overload.
2-1	3	POWER receptacle	Provides a connector for 28-volt direct current input to the heater.
2-1	4	THERMO receptacle	Provides a connector for the room thermostat which controls heater operation.
2-1	5	RESET switch	When pressed, switch resets heater circuits after heater has stopped due to ignition failure or lack of fuel.
2-1	6	ON-OFF switch	Controls starting and stopping of heater. In ON position, heater will start and operate under control of room thermostat. When placed in OFF position, switch stops heater operation. If motor blower is running when switch is moved to OFF, heater will continue to run until cool, then shut off.
2-2		Thermostat knob	Provides a means of selecting the temperature which heater is to maintain in the enclosure. Rotate knob until desired temperature is aligned with index mark.

NOTE

The thermostat provides only an on-off control of the heater. Raising the thermostat setting does not increase the heat output of the heater per unit of operating time. It merely causes the heater to run longer to satisfy the heat demand. Setting the thermostat to the highest setting at startup does not increase the rate at which the desired temperature will be reached. To prevent temperature overshoot, set the thermostat only to the temperature desired for the enclosure.



1. Spare fuse holder
2. Fuse holder
3. Power receptacle
4. Thermo receptacle
5. Reset switch
6. On-off switch

Figure 2-1. Heater controls and connectors.

Figure 2-2. Room thermostat.

2-3. Starting.

WARNING

Do not operate this heater in an enclosure unless exhaust gases are piped outside of the enclosure. The exhaust gases contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Failure to provide proper elimination of the exhaust will cause severe illness or death.

a. Preparation for Starting.

(1) Perform the preventive maintenance checks and services given in table 3-1.

(2) Check the setting of the thermostat knob (fig. 2-2). If necessary, adjust knob to the desired setting.

b. Starting Procedure.

(1) Place the ON-OFF switch (6, fig. 2-1) in the ON position. The heater will operate under control of the room thermostat, starting as the thermostat calls for heat, and stopping as the heat requirement is satisfied. While the heater runs, the blower circulates warm air in the enclosure.

(2) If the heater stops after a short time, check for an inadequate fuel supply and replenish if necessary. Allow 3 to 5 minutes for the time delay mechanism to cool, then press the RESET switch (5, fig. 2-1), and start the heater in the normal manner.

2-4. Operation.

a. After starting, the heater will run without operator control, cycling on and off under control of the room thermostat.

b. If the temperature in the enclosure becomes too high or too low, adjust the thermostat knob (fig. 2-2) to compensate.

c. If the type of fuel being used is changed from one operating period to another, the heater may smoke or operate erratically. Report the condition to organizational maintenance for adjustment.

2-5. Stopping.

a. To stop the heater, turn the ON-OFF switch (6, fig. 2-1) to OFF.

CAUTION

Do not disconnect the power cable connector or interrupt the electrical supply to the heater until it shuts down after the purge cycle is completed.

b. If the heater is operating at the time of shutoff, the blower motor will continue to run and the burner will continue to burn until all fuel has been purged from the heater. When the fuel is burned and the heater has cooled sufficiently, the heater will shut down.

Section II. OPERATION UNDER UNUSUAL CONDITIONS

2-6. Operation in Extreme Cold (Below 10°F) (-12.2°C).

A thermostatically controlled fuel heater automatically heats the fuel when the temperature drops below 40 ± 6°F (1.1° to 7.8°C). This preheating of the fuel aids combustion and ignition during extremely cold conditions. No operating procedures are required for this fuel heater. You should take the following steps during extremely cold conditions:

a. Keep the fuel tank full to prevent condensation of moisture in the tank.

b. Clean snow and ice from fuel tank filler to prevent them from entering fuel tank, causing freezing in fuel lines.

2-7. Operation at High Altitudes.

a. The heater is designed to operate at elevations up to 10,000 feet above sea level without special service or adjustment.

b. At 10,000-foot altitude, heat output may be reduced approximately 15 percent. This is a normal condition which cannot be prevented, but optimum performance can be obtained by following all service instructions carefully.

2-8. Operation Under Rainy or Humid Conditions.

a. Wipe all accessible exposed areas frequently.

b. Paint all chipped or scratched sur
rust.

c. Cover the heater when not in use

faces to prevent

CHAPTER 3
OPERATOR/CREW MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

No lubrication is required.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-1. General.

To ensure that the space heater is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in table 3-1. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noticed which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-2. Preventive Maintenance Checks and Services.

NOTE

This heater does not require any lubrication. All bearings are permanently lubricated.

Refer to table 3-1 for a tabulated listing of preventive maintenance checks and services which you must perform. The item numbers are listed consecutively and indicate the sequence of minimum requirements.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

NOTE

Within designated interval, these checks are to be performed in the order listed.

B-Before

Item No.	Interval B	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is Not Ready/ Available if:
			NOTE Keep heater clean. Ensure that air inlet and outlet are free of obstruction.	
1	•	Space Heater	Make the following walk around checks:	
			a. Check for fuel leaks and damaged fuel lines.	Any fuel leakage is found.
			b. Check all external electrical connections for proper installation and tightness.	
			NOTE During starting and operation, check for leaks. Check for loose, missing, or cracked parts. Check for unusual noise, and excessive vibration. Check for improper or excessive cycling, smoking exhaust, improper combustion, or any indication of a failing or defective component. If suspected, notify organizational maintenance.	

3-3. Servicing Standby Heaters.

a. Heaters on standby which have the fuel connections and power connections intact must be run periodically to prevent fuel in the lines from losing volatility. Fuel with low volatility will make heater starting difficult or impossible.

b. Every two weeks, run standby heaters long enough to replace residual fuel in the fuel system of each heater to ensure that the heaters will start when they are needed.

Section III. TROUBLESHOOTING

3-4. General.

a. This section contains troubleshooting information for locating and correcting most of the operating problems which may develop in the space heater. Each malfunction is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by the listed corrective actions, notify your supervisor.

3-5. Operator/Crew Maintenance Troubleshooting Chart.

Refer to table 3-2 for troubleshooting which is allocated to operator/crew maintenance levels.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 3-2. Operator/Crew Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).
Step 1. Check that power is applied to heater. **Connect heater to a source of 28-vdc power. Ensure that power is connected to the POWER receptacle.**
Step 2. Check that ON-OFF switch is ON. **Turn switch on.**
Step 3. Check room thermostat setting. **Thermostat setting must be higher than ambient temperature of enclosure to start heater operation.**
Step 4. Check RESET switch. **Press RESET switch to reset heater circuit. Start heater in normal manner.**
2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS FOR A SHORT TIME, THEN STOPS).
Step 1. Check that fuel tank contains fuel. **Replenish fuel supply.**
Step 2. Check that fuel supply has recently been replenished and that it contains no visible contaminants. **Replace fuel in lines and tank if it has become old or contaminated.**
3. HEATER OVERHEATS.
Check for airflow restrictions. **Clear area of obstructions to permit free passage of air into and out of heater.**

Section IV. MAINTENANCE PROCEDURES

3-6. Maintenance of Fuel Supply.

a. The heater will operate satisfactorily on any gasoline conforming to Specification MIL-G-3056, VV-G-76, or any other gasoline (leaded or aromatic) of up to 100-octane grade. It will also burn diesel fuel which conforms to Specification VV-F-800, Class DF-1, DF-2, or DF-A, having a cloud point of not less than -55°F (-48°C). Aircraft turbine fuels JP-4 and JP-5, conforming to Specification MIL-T-5624, will also operate this heater.

b. During operation in extremely cold temperatures it is important to keep the fuel tank full to prevent condensation in the tank. Moisture in the tank can enter the heater fuel system and interfere with proper combustion, or can freeze in the fuel line, stopping the flow of fuel.

3-7. Maintenance of Fuel Lines.

Check that the fuel lines and fittings between the fuel supply and the heater are not kinked, leaking, or otherwise damaged. Report leaks and other damage to organizational maintenance.

CHAPTER 4
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

4-1. Inspecting and Servicing the Equipment.

a. Prepare the heater for inspection and operation as outlined on DA Form 2258, Depreservation Guide for Vehicles and Equipment.

b. Inspect the entire heater for lost parts or for damage which may have occurred during shipment.

c. Check the controls for free operation.

d. Inspect for loose or missing hardware.

e. Inspect the thermostat for a broken or loose element.

f. Inspect all tubing, lines, and fittings to see that they are secure and free of breaks, kinks, and other damage.

g. Correct all deficiencies or report them to direct support maintenance.

4-2. Installation of Separately Packed Components.

The room thermostat and the power and thermostat connectors are separately packed. For installation of these components, refer to paragraph 4-3.

4-3. Installation or Setting Up Instructions.

WARNING

Do not locate the heater where expelled exhaust gases can be recirculated into inlet air openings of the heated space. Inhalation of exhaust fumes can cause serious illness or death.

a. Location.

(1) Locate the space heater near an outside wall so that the exhaust can be piped to the outside with a short direct run (fig. 4-1). The total length of the horizontal run of the exhaust pipe must not exceed 6 feet.

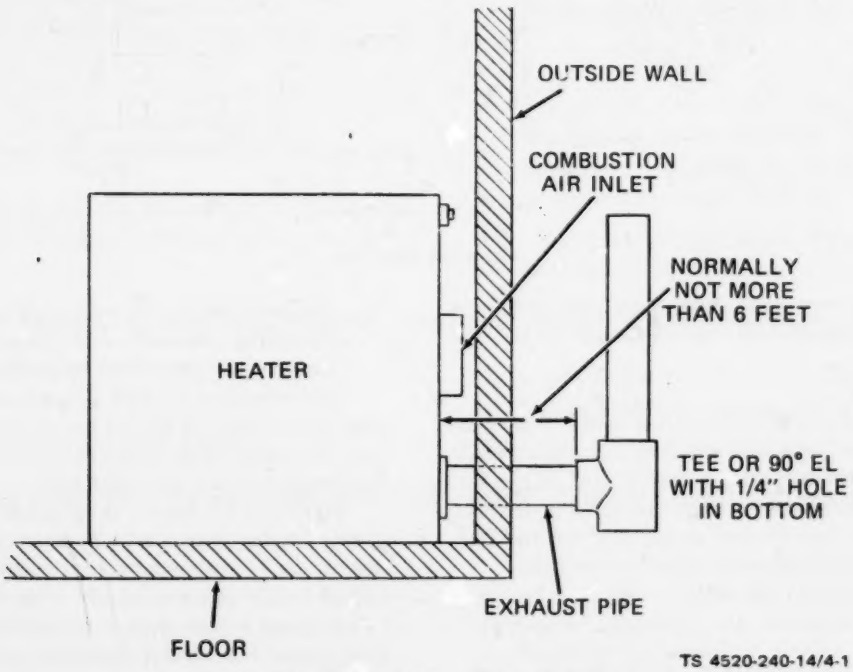


Figure 4-1. Typical exhaust connection.

(2) The space heater should be positioned at approximately the same level as the fuel source and should never be positioned more than 7 feet above the fuel source.

(3) Refer to the figure 4-2 and provide clearances as indicated to permit proper air circulation. Allow adequate room at the front and left side for control access and servicing.

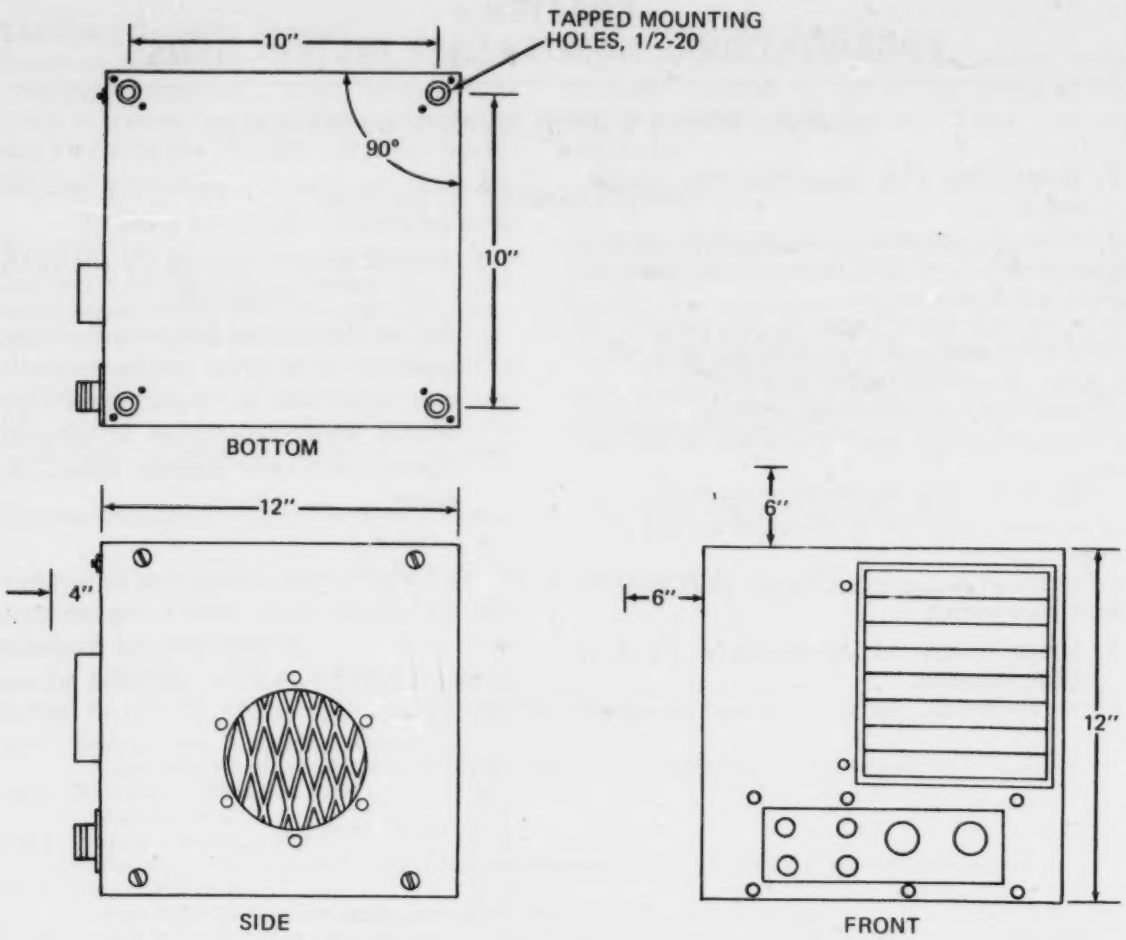


Figure 4-2. Base plan.

(4) The side cover panel and the top cover panel are interchangeable to provide alternate air intake installation.

b. Installation.

(1) Secure heater to base or floor using ½-20 bolts of suitable length (bolts not furnished with equipment).

(2) Connect the fuel inlet connector (fig. 1-2) on the heater to the fuel source, using suitable lines and fittings. Make sure that the fuel supply is clean and free of moisture. Check that connections do not leak.

WARNING

Do not operate the heater in an enclosed space unless the exhaust gases are piped to the outside. Inhalation of exhaust fumes will result in serious illness or death.

CAUTION

During operation, the exhaust pipe becomes hot enough to cause combustion of wood or other flammable building materials. Provide adequate fireproofing insulation between the exhaust pipe and wall to prevent fire.

(3) Connect a 1¼-inch exhaust pipe from the e haust connection on the heater to the outside (fig. 4- Seal all exhaust pipe joints using anti-seize compou meeting specification JAN-A-669.

(4) When the heater is operated in a tightly co structed compartment which restricts inlet of combu tion air, it is recommended that combustion air be co nected to the combustion air inlet from an extern source, using a hose or pipe. Invert the rain shield (f 1-2) to provide a straight-through opening of the co bustion air inlet. Combustion air piping is necessary prevent depletion of oxygen in an extremely tig enclosure.

(5) Mount the room thermostat in an upright po tion on an inside or insulated wall in the area to heated. Do not install the thermostat in line with t heater air inlet or discharge air flow, in a drafty po

tion, or on an outside wall.

(6) Remove the thermostat cover and attach to the thermostat a shielded 3-wire cable, long enough to reach between heater and thermostat, securing the cable ground (green) wire to one of the thermostat mounting screws. Attach the other end of the cable to the male connector that is shipped separately. Make sure the ground wire of the cable is connected to the ground lug of the connector (pin B). Connect the connector to the room THERMO receptacle (4, fig. 2-1) on the heater control panel.

NOTE

If the combined length of power cable and thermostat cable does not exceed 20 feet, use 14-gage cable for both applications. If the combined length exceeds 20 feet, use 12-gage cable.

(7) Prepare a dc power cord using a 3-wire cable and the dc connector provided with the heater. The B terminal must be negative (-) and the A terminal must be positive (+). Connect the ground to the C terminal. Connect the cable between the 28-volt dc power source and the POWER receptacle (3, fig. 2-1).

c. Initial Checkout and Adjustment. After installation, check heater operation as follows:

(1) With the thermostat knob (fig. 2-2) set to less than ambient temperature, set the ON-OFF switch to the ON position. The heater must not start.

(2) Start heater operation (para 2-3) by setting the thermostat knob to a temperature above ambient to cause heater ignition.

(3) Check that the blower motor starts and that the unit circulates air.

(4) After warmup, check the exhaust for smoke and check for erratic operation. If either condition exists, adjust the fuel adjustment needle (para 4-23*a*).

(5) Check that the heater shuts off when the thermostat set temperature is reached in the enclosure. If conditions permit, check that the unit cycles under control of the room thermostat.

(6) Stop the heater by operating the control switch to OFF. If the heater is burning when the switch is operated to OFF, the flame will go out immediately, but the blower motor will continue to run until the heat is purged from the burner, after which it will stop.

(7) Refer to Table 4-2, Troubleshooting, if the unit fails to operate in the required manner.

Section II. MOVEMENT TO NEW WORKSITE

4-4. Dismantling for Movement.

a. Disconnect the fuel line from the fuel inlet connector.

b. Operate the heater until residual fuel is expended, then place the cap on the fuel connection.

c. Disconnect the exhaust pipe from the exhaust connection.

d. Remove the thermostat; disconnect the thermostat and power cable connectors from mating receptacles on the control panel.

e. Remove the bolts securing the heater to the base or floor.

f. Remove, drain, and reinstall the fuel bowl of the fuel strainer. Remove the fuel pump cover (2, fig. 4-11) to drain the fuel pump. Reinstall cover.

g. Remove the plug from the float bowl and tip the heater sideways to drain the fuel.

4-5. Reinstallation after Movement.

Refer to paragraph 4-3 for installation instructions.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-6. Special Tools and Equipment.

No special tools or equipment is required.

4-7. Maintenance Repair Parts.

Repair parts and equipment are listed and illustrated in TM 5-4520-240-24P, Repair Parts and Special Tools List.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-8. General.

This section lists the preventive maintenance checks and services which shall be performed on a quarterly and semiannually basis by organizational maintenance personnel. It includes and expands upon the preventive maintenance services performed by operator/crew maintenance and includes additional services which are allocated to organizational maintenance.

4-9. Preventive Maintenance Checks and Services.

Consult table 4-1 for a listing of the preventive maintenance checks and services which are allocated to organizational maintenance.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Q-Quarterly S-Semiannually

Item No.	Interval Q	Interval S	Item to be Inspected	Procedures
1	●		Housing Assembly	Remove top and side panels from space heater. Clean inside and outside of heater unit using a dry cloth to wipe away oil, dirt, dust, fuel, and lint. Check fuel system for leaks, damage, loose fittings, and loose or missing hardware. Check electrical wiring for damage and loose connections. Check components for evidence of overheating, loose hardware, and damage.
2	●		Fuel Strainer	Remove and clean fuel sediment bowl and filter element.
3		●	Fuel Pump Filter	Remove and clean fuel pump filter.

Section V. TROUBLESHOOTING

4-10. General.

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the space heater. Each malfunction is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. Perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. Only those functions which are solely within the scope of organizational maintenance are listed.

4-11. Organizational Maintenance Troubleshooting Chart.

Refer to table 4-2 for troubleshooting which is allocated to organizational maintenance levels.

NOTE

Before you use this table, be sure you have performed all applicable operating checks (para 4-3*c*).

Table 4-2. Organizational Maintenance Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
WARNING **The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always disconnect the power cable connector before making any continuity tests.**
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).
Step 1. Check that fuse is not blown. **Replace blown fuse.**
Step 2. Inspect room thermostat wiring for loose connections. **Tighten loose connections or repair broken leads.**
Step 3. Turn the ON-OFF switch on. Set thermostat to its highest settings, remove cover, and jump thermostat terminals with an insulated screwdriver. **Replace thermostat if heater starts when jumped.**
2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS UNTIL RESET SWITCH TRIPS).
Step 1. Remove fuel strainer filter element and check for clogging. **Service fuel strainer (para 4-21*a*).**
Step 2. Check that fuel pump filter is not clogged. **Service fuel pump filter (para 4-22*a*).**
Step 3. Check that power is available to fuel pump and fuel solenoid (fig. 1-4). **If no power is available, check electrical connections.**
Step 4. Disconnect fuel tube at float bowl inlet and turn power on. **Replace fuel pump if power is available but no fuel flows from fuel tube.**
Step 5. Remove the igniter and check for damage (para 4-30). **Replace a damaged igniter.**
Step 6. Remove glow plug and ground it against unpainted surface of burner. Attempt to start heater. **Replace glow plug if it fails to heat (para 4-30).**
Step 7. Remove fuel adjustment needle. Turn power on, and check that fuel flows from opening. **Replace solenoid coil if no fuel flows (para 4-23).**
3. HEATER IGNITES BUT BLOWER FAILS TO RUN.
Check that motor brushes are not worn, burned, or damaged. **Replace brushes if brush lead is broken, or if brushes are burned or worn to less than 5/16 inch (para 4-27).**
4. HEATER OVERHEATS, CYCLING UNDER CONTROL OF OVERHEAT THERMOSTAT.
Step 1. Check for restricted air flow. **Remove any obstacles restricting air flow.**
Step 2. Check motor for worn or damaged brushes that could cause slow motor and fan speed. **Replace brushes if a brush lead is broken, or if brushes are burned or are worn to less than 5/16 inch (para 4-27).**
5. HEATER BACKFIRES.
Step 1. Check that fuel adjustment is correct. **Adjust fuel adjustment needle (para 4-23*a*).**

Table 4-2. Organizational Maintenance Troubleshooting—Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CAUTION

When checking spark, do not allow spark gap to exceed ⅛ inch. Greater gap will cause excessively high potential buildup resulting in insulation breakdown either internally or in the ignition cable.

Step 2. Remove ignition cable from igniter and position cable so that cable end is ⅛ inch from a grounded surface. Turn power on
If spark is weak or intermittent, report to direct support maintenance.

Step 3. Remove igniter and check for damage.
Replace a damaged igniter (para 4-30).

Step 4. Check exhaust system for obstructions.
Remove exhaust obstructions.

Step 5. Check that exhaust piping is installed as shown in figure 4-1.
Revise exhaust piping to conform to requirements listed in paragraph 4-3.

6. HEATER CYCLES ON AND OFF EXCESSIVELY.

Step 1. Check that room thermostat is installed as described in paragraph 4-3.
Relocate improperly installed thermostat as specified in paragraph 4-3.

Step 2. Disconnect thermostat power cable from thermostat. Use a multimeter set to read 1X resistance and check continuity across thermostat contacts while operating thermostat temperature control. Continuity must be made sharply as temperature control is moved up to and past ambient temperature. Continuity must be broken sharply as temperature control is moved down to and past ambient temperature.
Replace thermostat if contact operation is intermittent or erratic (para 4-3).

7. HEATER SMOKES.

Step 1. Check that fuel adjustment is correct.
Adjust fuel adjustment needle (para 4-23*a*).

Step 2. Check that combustion air inlet is not blocked or dirty.
Clean or repair combustion air inlet or replace damaged parts (para 4-18).

Step 3. Remove side cover panel and check that combustion air hose is not torn or restricted.
Replace a damaged combustion air hose (para 4-30).

Step 4. Check that carburetor float bowl controls fuel flow. With the heater energized and the fuel pump running, remove the slotted plug from the top side of the fuel bowl. No fuel should flow through opening.
Replace a defective carburetor (para 4-23).

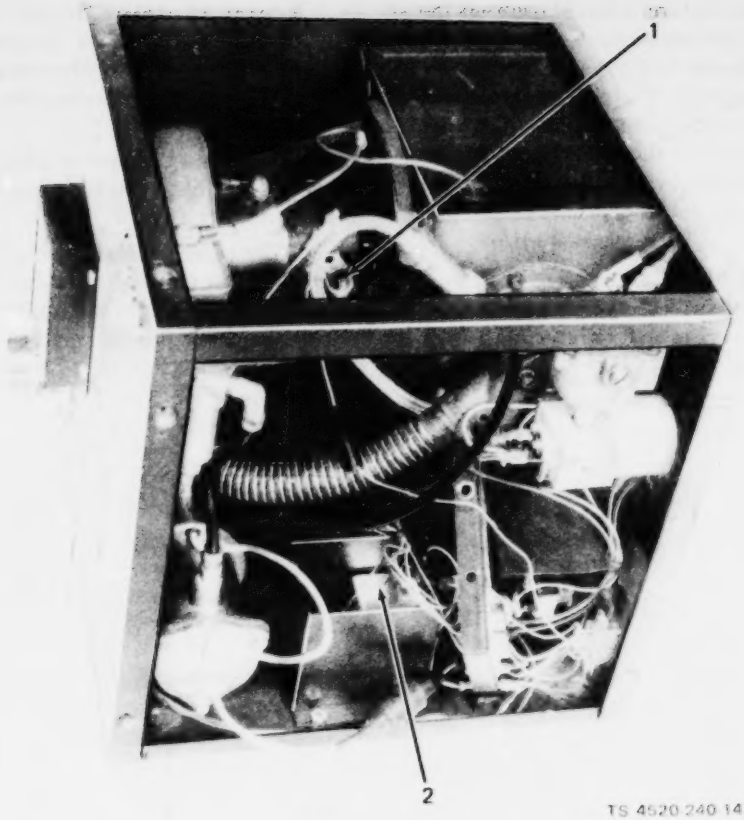
Section VI. RADIO INTERFERENCE SUPPRESSION

4-12. General Methods Used to Attain Proper Suppression.

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition wires, installing a capacitor on the blower motor, and installation of an rf filter in the ignition power supply.

4-13. Primary Interference Suppression Components.

a. A 0.47 microfarad, 200 vdc capacitor (1, fig. 4-3) is installed on the blower motor at the motor terminal. This capacitor suppresses the radio frequency interference generated by the arcing of the brushes at the motor commutator.



1. Suppression capacitor
2. Rf filter

Figure 4-3. Primary radio interference suppression components.

b. An rf filter (2) is installed in the ignition power supply. This device passes direct current but filters out the rf component of the input power.

4-14. Replacement of Suppression Components.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Suppression Capacitor. Refer replacement of blower motor suppression capacitor (1, fig. 4-3) to direct support maintenance.

b. Rf Filter. Refer replacement of ignition power supply rf filter (2) to direct support maintenance.

4-15. Secondary Interference Suppression Components.

a. Component Identification. The secondary suppression components on the space heater are the shielded high tension ignition cable (4, fig. 4-7) from the ignition power supply (12) to the igniter (5), and the shielded igniter.

b. Component Replacement.

(1) The ignition cable is manufactured as part of the ignition power supply and is not serviceable separately. Refer to direct support maintenance to replace the ignition power supply if the ignition cable is defective.

(2) Replace the igniter per paragraph 4-30.

4-16. Testing of Radio Interference Suppression Components.

Refer testing of suppression capacitor to direct support maintenance.

Section VII. MAINTENANCE OF HEATER HOUSING ASSEMBLY

4-17. Description.

a. Cover Panels and Case. The heater housing assembly contains and mounts the heater components. The warm air louver (fig. 1-1) snaps into place, and you can rotate it to any one of four positions to direct the flow of heated air up, down, or to either side. The top

and side cover panels are interchangeable so that the ventilation air inlet screen can be positioned either on the top or side, as the heater location requires.

b. Control Panel Assembly. The control panel (fig. 1-1) mounts all of the operator controls and the inlet connectors. It is installed at the lower front of the heater case. Its components are connected into the heater electrical system by solder-type and screw-type connectors.

4-18. Cover Panels and Case.

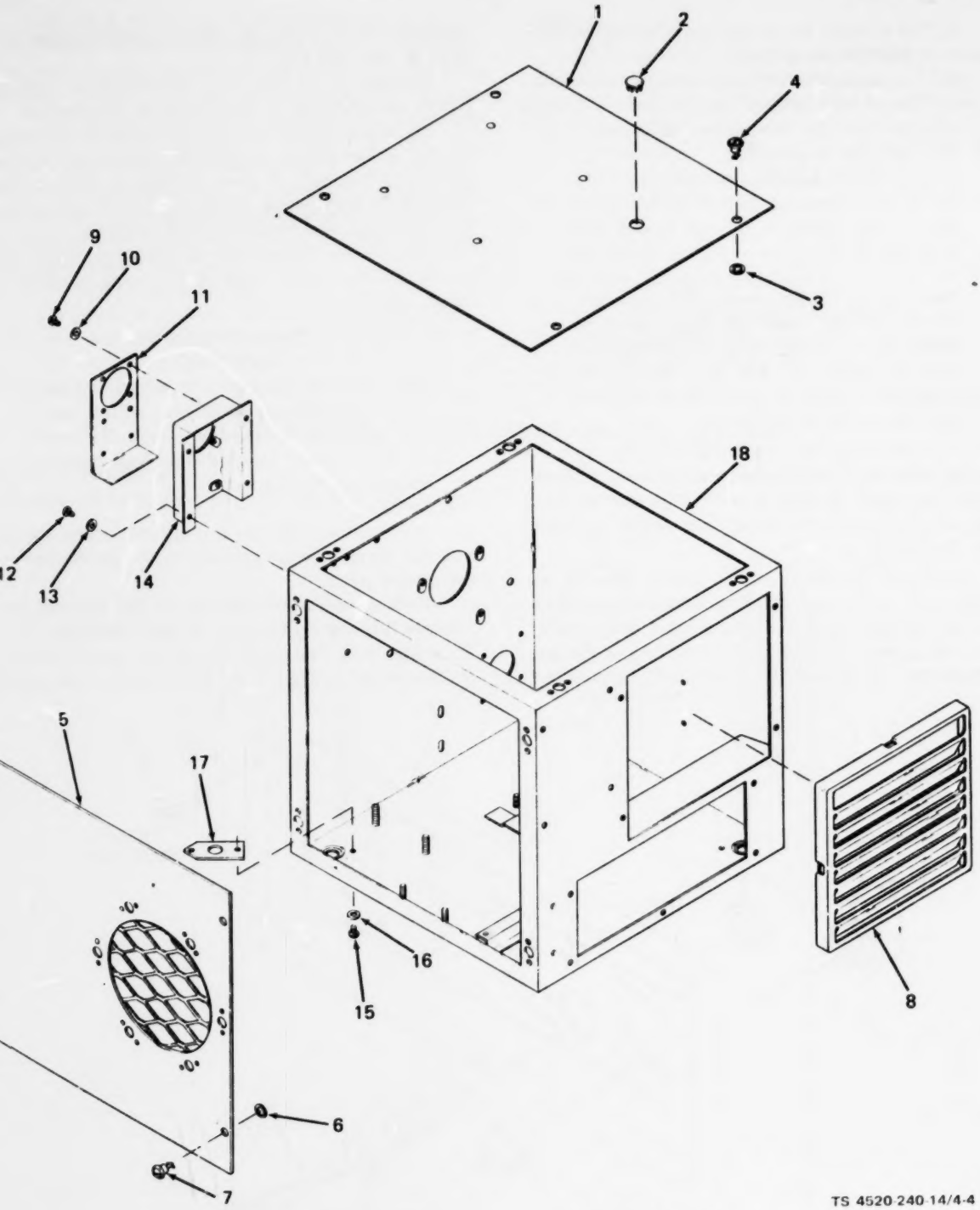
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disassembly.

(1) Disconnect the power plug before removing the cover panels, unless you are going to perform operating tests or adjustments.

(2) The cover panels (1 and 5, fig. 4-4) are secured to the heater case (18) with twist-lock type studs (4 and 7). Give each stud a quarter turn counterclockwise to release the cover panels.



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1. Top cover panel
2. Plug
3. Washer
4. Stud
5. Side cover panel
6. Washer
7. Stud
8. Warm air louver
9. Screw
10. Lock washer
11. Rain shield
12. Screw
13. Lock washer
14. Combustion air inlet
15. Screw
16. Lock washer
17. Nut plate
18. Heater case

Figure 4-4. Heater housing assembly, exploded view.

(3) Pull straight out on the warm air louver (8) to remove it from the housing.

(4) If the nut plates (17) are damaged, remove the screws (15) and lock washers (16) that secure them to the bottom of the case; remove the nut plates.

b. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Using a dry cloth, wipe dust and lint from the top and side cover panels, warm air louver, and combustion air inlet. Remove greasy or gummy deposits with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680).

(2) Check the inside of the heater case for accumulations of dust and lint. If vacuum cleaning equipment is available, use it to clean the inside of the heater case, taking care not to disturb the wiring or damage components. If vacuum cleaning equipment is not available, use a clean, dry cloth to remove accumulations of dust and lint.

(3) If any of the data plates are defaced or illegible, report the condition to direct support maintenance.

(4) Before reinstalling covers and warm air louver, inspect heater components for fuel leaks, signs of burning or overheating, or other damage or malfunction. Refer to the appropriate repair sections of this publication for repair and replacement procedures.

c. Reassembly. Reassemble the heater case and cover panels in the reverse order of the index numbers in figure 4-4.

4-19. Control Panel Components.

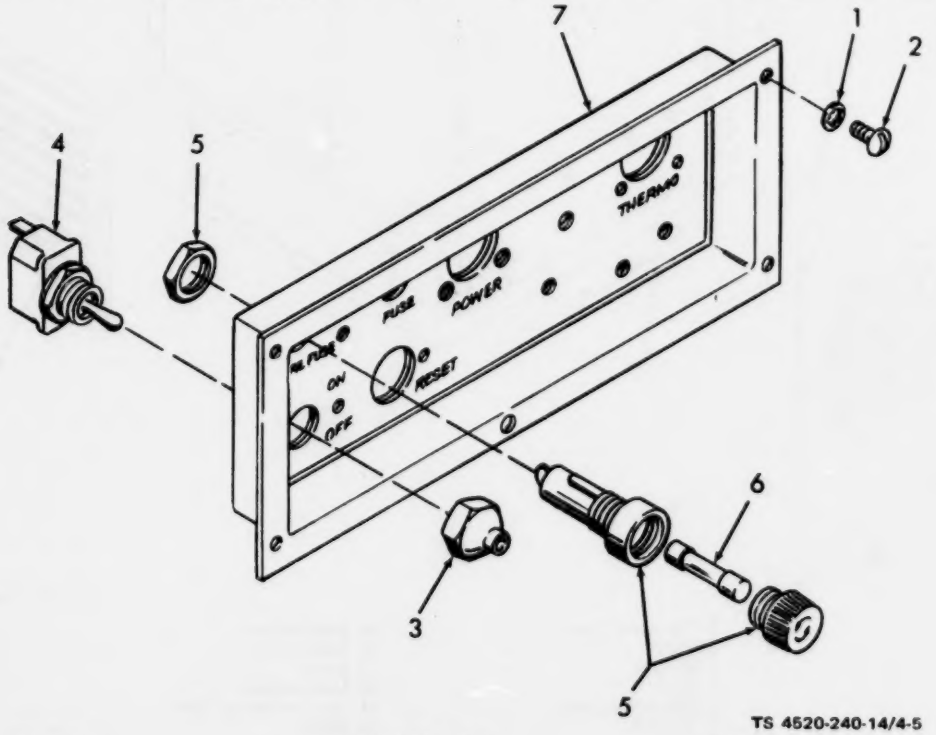
WARNING

The ignition system of this heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Removal.

(1) Disconnect the power plug and remove the top and side cover panels to provide access to the back of the control panel.

(2) Remove the five screws (1, fig. 4-5) and lock washers (2) securing the control panel assembly (7) to the heater case. Pull out gently on the control panel to provide access to the wiring on the back of the panel.



1. Screw
2. Lock washer
3. Boot
4. On-off switch
5. Fuseholder (including nut)
6. Fuse
7. Control panel assembly

Figure 4-5. Control panel, exploded view.

(3) Check continuity of ON-OFF Switch (4) using a multimeter set on OHMS scale. If switch is defective, tag and unsolder the two red and two violet leads from switch. Unscrew boot (3) and remove ON-OFF Switch.

(4) Push in the cap on the fuseholder (5) and rotate the cap counterclockwise to remove it from the fuseholder. Remove the fuse (6) from the fuseholder. Tag and unsolder the two red wires from the fuseholder. Remove the fuseholder nut and pull the fuseholder from the front of the control panel. Remove the spare fuseholder the same way.

b. Cleaning and Inspection.

(1) Clean the switch and fuseholders with a clean, dry cloth or a soft-bristle brush.

(2) Do not repair the ON-OFF switch or fuseholders. Replace these parts if they are damaged or defective.

(3) Inspect the THERMO and POWER receptacles in the control panel for cracks, damaged terminals, and signs of overheating. Report defective receptacles to direct support maintenance.

c. Installation.

(1) Installation of the control panel components is the reverse of removal. Refer to figure 4-5.

(2) Use only rosin-core solder for soldered connections. Consult the wiring diagram (fig. 1-4) for correct wiring connections.

(3) Secure the assembled control panel to the heater case with the five screws (1, fig. 4-5) and lock washers (2). Reinstall the top and side cover panels, connect the power plug, and check heater operation.

Section VIII. MAINTENANCE OF FUEL SYSTEM

4-20. Description.

The space heater fuel system consists of a fuel strainer, fuel pump, carburetor, solenoid valve, and the interconnecting lines and fittings. Refer to figure 4-6.

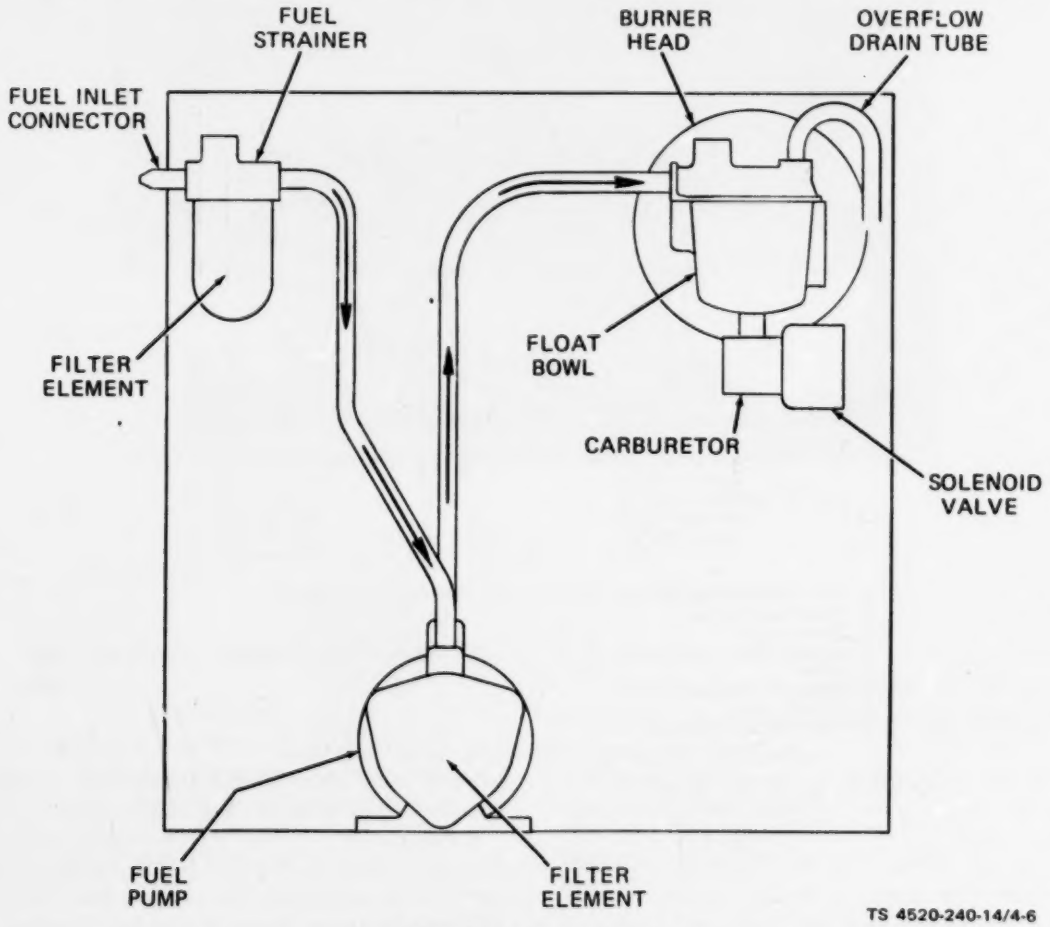
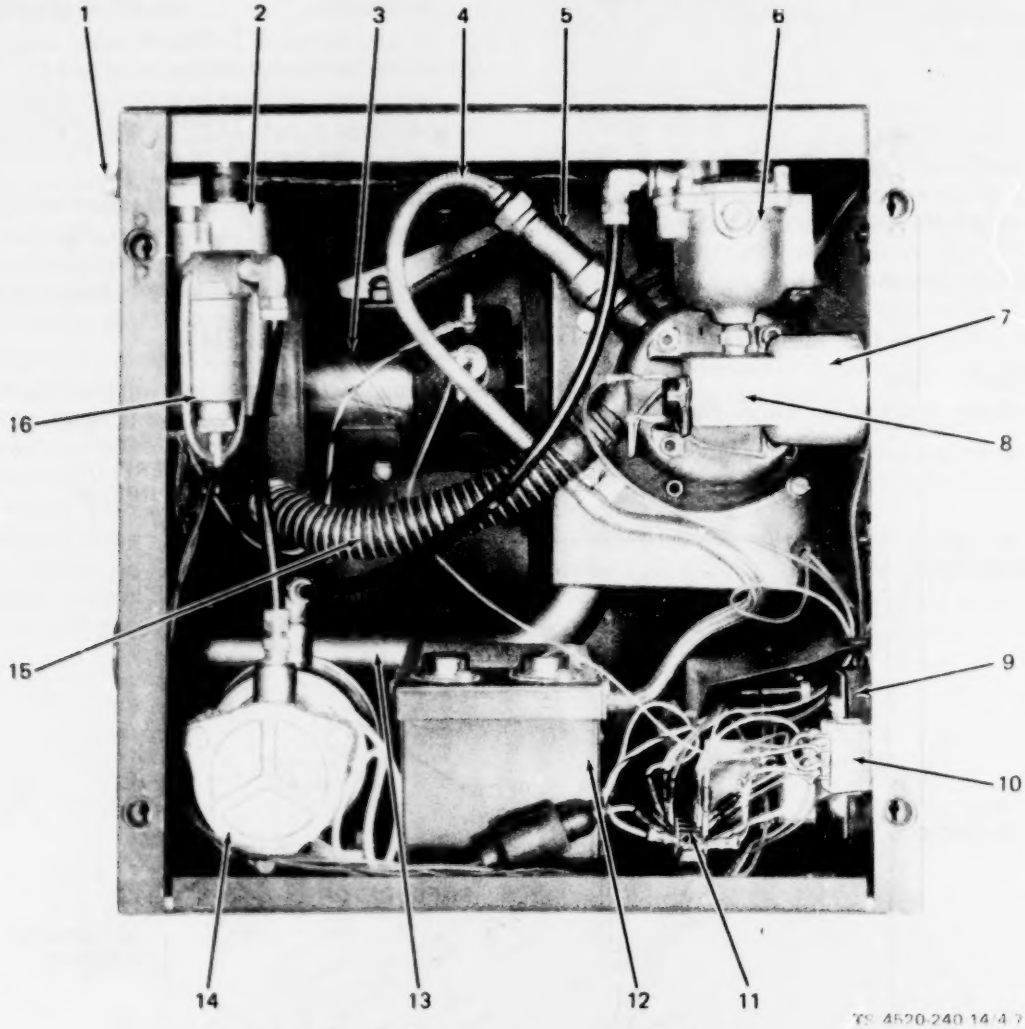


Figure 4-6. Fuel flow diagram.

a. Fuel Strainer. The fuel strainer (16, fig. 4-7) traps and holds dirt, moisture, and other contaminants before they enter the heater fuel system. The fuel strainer has a metal disc-type element contained in a removable sediment bowl.

b. Fuel Pump. A 28-volt, pulsating-type electric fuel pump (14) draws fuel from the fuel supply and pumps it to the carburetor. The pump also contains a filter to remove any contaminants which may have passed through the fuel strainer.



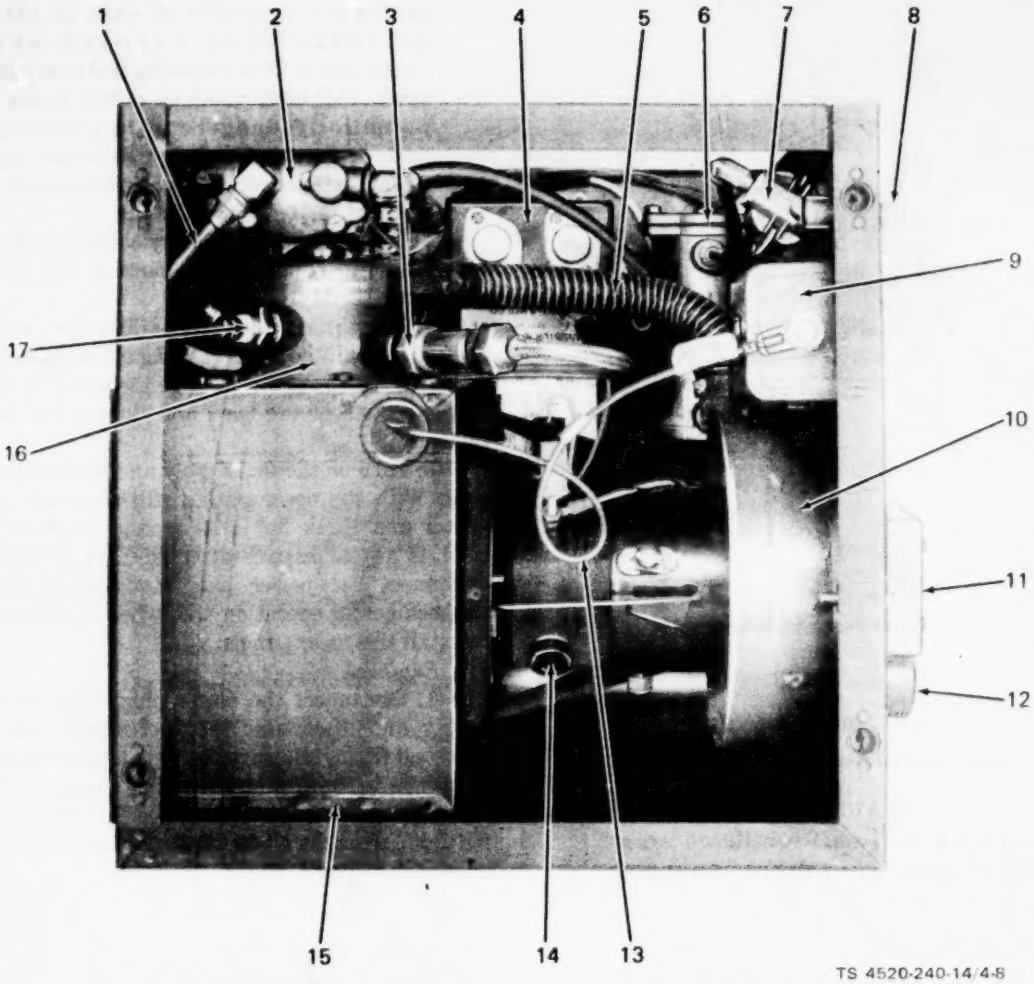
1. Fuel inlet bulkhead fitting
2. Thermocouple relay
3. Blower motor
4. Ignition cable
5. Igniter
6. Carburetor fuel float bowl
7. Solenoid valve
8. Fuel adjustment needle
9. Control panel
10. Control relay
11. Terminal block
12. Ignition power supply
13. Exhaust pipe
14. Fuel pump
15. Air inlet hose
16. Fuel strainer

Figure 4-7. Side view of heater showing internal components.

c. Carburetor. The carburetor meters the flow of fuel to the burner head to achieve efficient combustion. Sensitive adjustment of this flow is provided by a fuel adjustment needle (8) which enables you to manually adjust the flow rate according to the burning characteristics of the various fuels this heater will burn.

d. Solenoid Valve. The solenoid valve (7) controls the flow of fuel from the carburetor fuel float bowl (6) to the fuel nozzle. This electrically controlled device opens the fuel valve when the thermostat calls for heat and closes the valve when the heat requirement is satisfied.

e. Fuel Lines. Flexible fuel tubes carry the fuel from the fuel strainer to the fuel pump, and from the fuel pump to the carburetor. An overflow drain tube (1, fig. 4-8) from the top of the carburetor fuel float bowl (2) to the burner head (16) vents excess fuel to the burner head in the event of carburetor malfunction.



1. Overflow drain tube
2. Carburetor fuel float bowl
3. Igniter
4. Ignition power supply
5. Air inlet hose
6. Fuel pump
7. Fuel strainer
8. Fuel inlet bulkhead fitting
9. Thermocouple relay
10. Blower assembly
11. Combustion air inlet
12. Exhaust pipe connector
13. Thermocouple lead
14. Blower motor
15. Heat exchanger housing
16. Burner head
17. Glow plug

Figure 4-8. Top view of heater showing internal components.

4-21. Fuel Strainer, Fuel Lines, and Fittings.

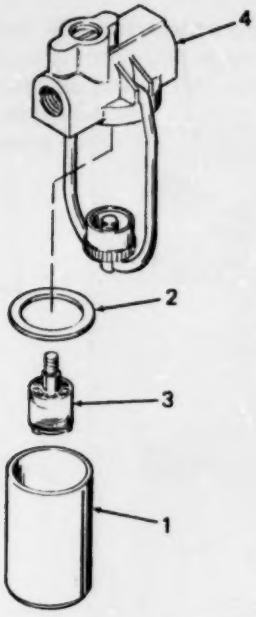
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

a. Fuel Strainer Service.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels to provide access to the fuel strainer.

(2) Loosen the nut on the fuel strainer bail. Swing the bail aside and remove the fuel bowl (1, fig. 4-9), gasket (2), and filter element (3) from the fuel strainer body (4).



TS 4520-240-14/4-9

1. Bowl
2. Gasket
3. Filter element
4. Fuel strainer body

Figure 4-9. Fuel strainer, exploded view.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to clean solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(3) Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly.

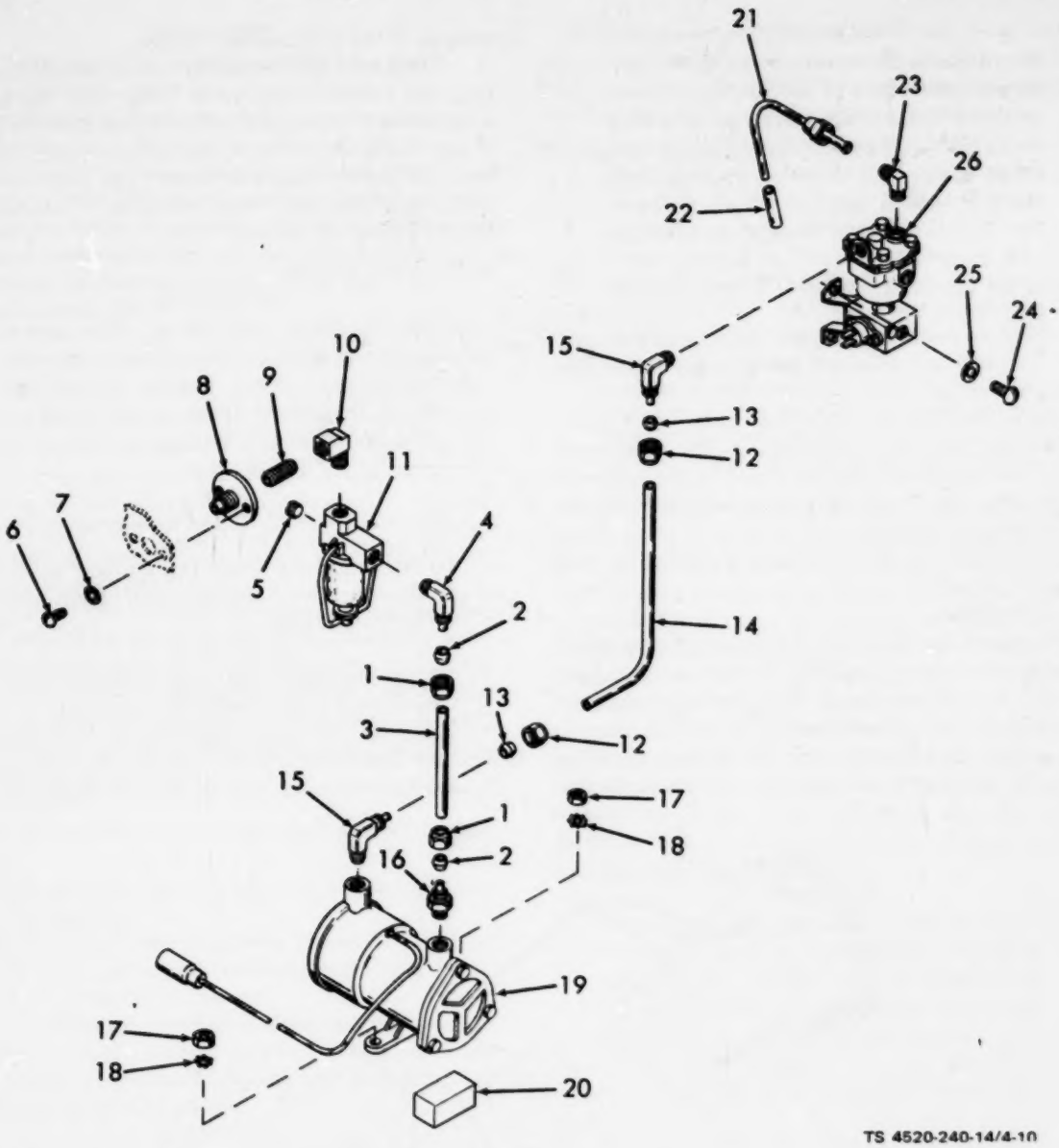
(4) Install the filter element (3) in the fuel strainer body (4). Install the bowl (1), using a new gasket (2), and swing the bail in place. Engage the screw in the notch in the bottom of the bowl and tighten the nut hand tight.

(5) Turn on the fuel supply and connect the power plug. With the cover panels still removed, start the heater and check for leaks around the fuel strainer bowl. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when it is satisfactory, reinstall the cover panels.

b. Removal.

(1) Disconnect the power plug. Shut off the fuel supply and disconnect the fuel supply line at the bulkhead fitting. Remove the top and side cover panels for access to the fuel strainer, fuel lines, and fittings.

(2) Disconnect the assembled fuel tube (1 thru 3, fig. 4-10), from the elbow (4) at the fuel strainer outlet and the fuel pump inlet.



1. Compression nut
2. Compression sleeve
3. Fuel tube
4. Elbow
5. Plug
6. Screw
7. Lock washer
8. Bulkhead fitting
9. Close nipple
10. Elbow
11. Fuel strainer
12. Compression nut
13. Compression sleeve
14. Fuel tube
15. Elbow
16. Connector
17. Nut
18. Lock washer
19. Fuel pump
20. Pad
21. Overflow tube
22. Tube
23. Elbow
24. Screw
25. Lock washer
26. Carburetor

Figure 4-10. Fuel system, exploded view.

(3) Remove the elbow (4) and plug (5) from the fuel strainer (11). Remove the two screws (6) and lock washers (7) securing the bulkhead fitting (8) to the heater case. Disassemble the bulkhead fitting, close nipple (9), and elbow (10), and remove them from the fuel strainer (11).

(4) Disconnect the assembled fuel tube (12 thru 14) from the fuel pump outlet and the carburetor inlet. Remove the elbows (15) and the connector (16).

c. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before assembly.

(2) Inspect the fuel tubes for cracks, worn spots, restrictions, and other damage. Replace damaged tubes. The compression sleeves (2 and 13, fig. 4-10) and compression nuts (1 and 12) must be replaced when the fuel tubes are replaced.

(3) Replace any fittings that are cracked or have damaged threads.

d. Installation.

(1) Install the fuel lines, fittings, and fuel strainer in the reverse order of the index numbers in figure 4-10.

(2) Use Permatex No. 1, or equivalent, to coat the male NPT threads of the elbows (4, 10, and 15), plug (5), close nipple (9), and connector (16) before installing them. Do not apply any sealing compound to the threads of the compression fittings.

(3) Connect the fuel supply line to the bulkhead fitting and reconnect the power plug. Start the heater with the cover panels still removed and check for leaks. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when operation is satisfactory, reinstall the cover panels.

4-22. Fuel Pump.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Fuel Pump Filter Service.

NOTE

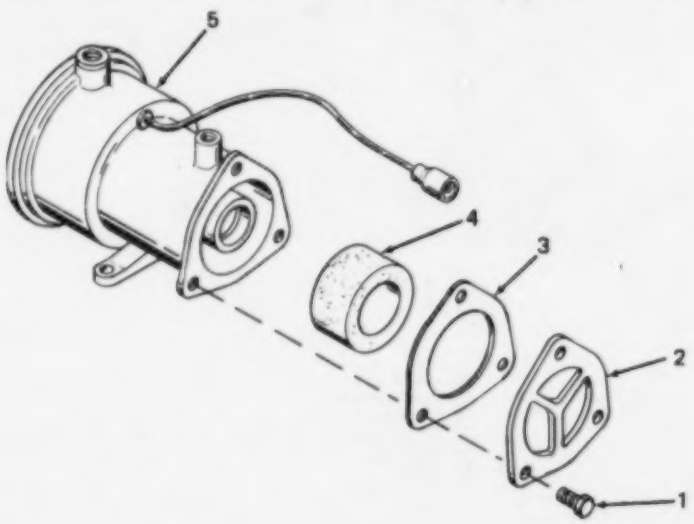
You can service the fuel pump filter without removing the fuel pump from the heater case.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels for access to the fuel pump filter.

CAUTION

Have container available to catch fuel when fuel pump cover is removed.

(2) Remove the three screws (1, fig. 4-11) securing the cover (2) to the fuel pump. Remove the cover, gasket (3), and filter element (4) from the fuel pump (5).



TS 4520-240-14/4-11

1. Screw
2. Cover
3. Gasket
4. Filter element
5. Fuel pump

Figure 4-11. Fuel pump filter, exploded view.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(3) Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly. Replace the fuel pump filter element if it cannot be cleaned with cleaning solvent, or if it is cracked or damaged. Check the magnet in the cover to make sure all metal chips are removed.

(4) Install the filter element (4, fig. 4-11) in the fuel pump (5). Make sure the filter element is fully seated and install the cover (2) using a new gasket (3). Secure with the three screws (1).

(5) Open the fuel supply valve and connect the power plug. With the cover panels still removed, start the heater and check for leaks around the fuel pump filter cover. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Retest heater operation and, when it is satisfactory, reinstall the cover panels.

b. Removal.

(1) Disconnect the power plug and shut off the fuel supply.

(2) Remove the top and side cover panels for access to the fuel pump.

(3) Disconnect the fuel tubes (3 and 14, fig. 4-10) from the fuel pump (19). Disconnect the fuel pump electrical lead at the connector.

(4) Remove the two nuts (17) and lock washers (18) that secure the fuel pump (19) to the bottom of the heater case; remove the fuel pump and pad (20).

c. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Clean the exterior of the fuel pump with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Dry thoroughly.

(2) Inspect the fuel pump for cracks, damaged threads, damaged electrical lead or connector, and other visible damage; replace a defective fuel pump.

d. Installation. Installation of the fuel pump is the reverse of removal; refer to figure 4-10. Make the fuel line and electrical connections. Install the top and side cover panels, and check for proper operation.

4-23. Carburetor and Solenoid Valve.

a. Fuel Adjustment. When the type of fuel being burned in the heater is changed, or when the heater is subjected to extremely low ambient temperatures, it will normally be necessary to readjust the fuel adjustment needle (8, fig. 4-7) on the carburetor for proper combustion.

NOTE

You can adjust the fuel adjustment needle without removing the side cover panel. Depending on which cover is installed on the side of the heater, you can make the adjustment through the ventilation air inlet screen or through the access hole after removing the plug (2, fig. 4-4).

(1) If heater smokes, turn the fuel adjustment needle ⅛ turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional ⅛ turn and observe operation. Continue until operation is satisfactory.

(2) If heater operation is erratic, or if heater fails to operate properly in extremely low ambient temperatures, turn the fuel adjustment needle ⅛ turn counterclockwise to increase fuel flow. Observe operation for 1 minute. Continue to turn the needle counterclockwise ⅛ turn at a time until heater operation is satisfactory. When heater is burning smoothly, there should be little or no smoke from the exhaust outlet.

b. Removal and Disassembly.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

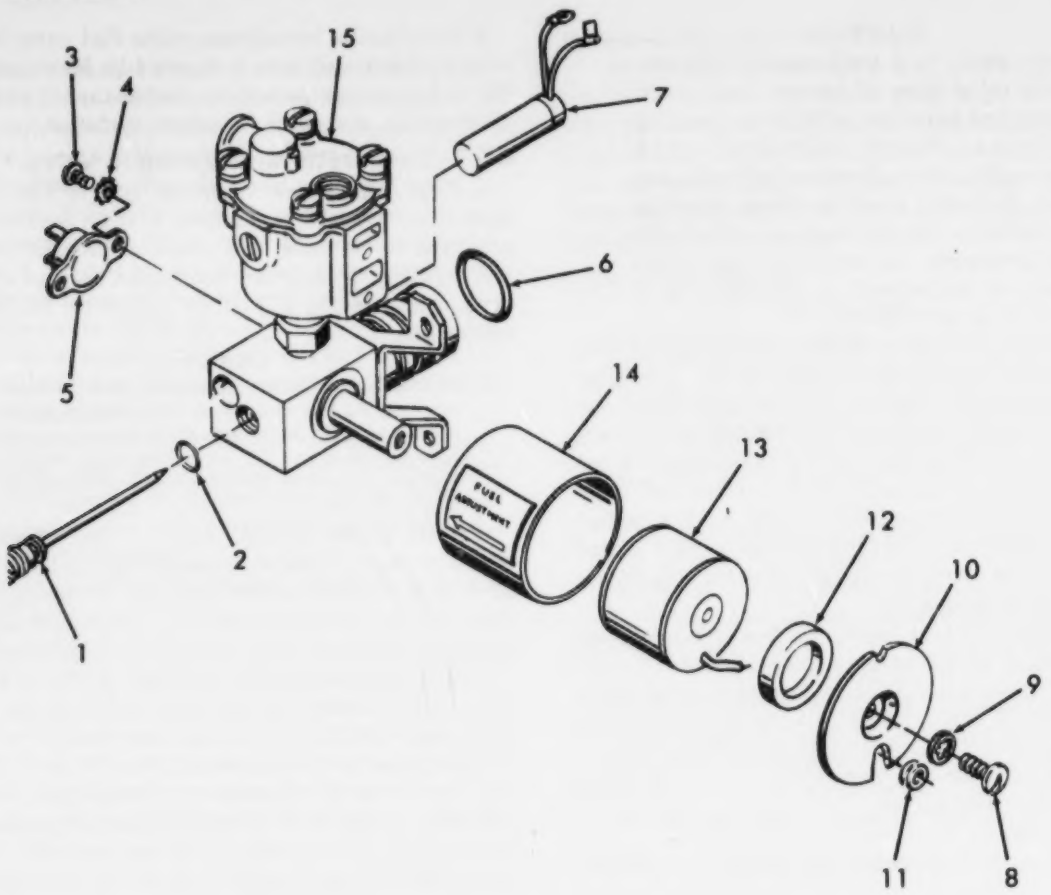
(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels for access to the carburetor.

(2) Tag and disconnect the fuel preheat thermostat leads and the leads from the fuel solenoid valve (7, fig. 4-7).

(3) Disconnect the compression nut (12, fig. 4-10) of the fuel tube (14) at the elbow (15) in the carburetor fuel inlet, and remove the elbow. Disconnect the overflow tube (21) from the elbow (23) on the top of the carburetor (26). Remove the overflow tube and the tube (22).

(4) Remove the four screws (24) and lock washers (25) securing the carburetor to the burner head, and remove the carburetor.

(5) Unscrew the fuel adjustment needle (1, fig. 4-12) and remove the preformed packing (2) from the groove in the needle. Remove the two screws (3) and lock washers (4) securing the preheat thermostat (5) to the carburetor (15), and remove the thermostat.



TS 4520-240-14/4-12

1. Fuel adjustment needle
2. Preformed packing
3. Screw
4. Lock washer
5. Preheat thermostat
6. Preformed packing
7. Fuel heater
8. Screw
9. Lock washer
10. Solenoid cap
11. Grommet
12. Washer
13. Solenoid coil
14. Coil housing
15. Carburetor

Figure 4-12. Carburetor and solenoid valve, exploded view.

(6) Pull the fuel heater (7) from the nozzle end of the carburetor.

(7) Remove the screw (8) and lock washer (9) securing the solenoid cap (10) to the carburetor. Push the grommet (11) from the slot in the cap to free the solenoid lead. Remove the solenoid cap and the washer (12), and remove the solenoid coil (13) and coil housing (14) from the carburetor. Remove the preformed packing (6) from the burner end of the carburetor.

c. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow parts to dry thoroughly before reassembly. Do not immerse the thermostat, solenoid coil, or carburetor in solvent.

(2) Inspect the fuel adjustment needle tip for wear, scoring, or other damage. Replace the fuel adjustment needle if the needle is bent or damaged.

(3) Test the preheat thermostat for continuity. The thermostat contacts must be open (no continuity) at temperature of 55° ± 6°F (9.4° to 16°C). The contacts must be closed (continuity) at a temperature of 40°

±6°F (1.1° to 7.8°C). Replace the thermostat if it does not perform as described.

(4) Test the fuel heater for proper operation. Connect the two heater leads to a source of 28-volt dc power. Replace the heater if it does not heat.

(5) Test the solenoid coil for continuity between the insulated lead and the braided ground lead. Replace the coil if it is open, if the coil insulation is damaged, or if the coil shows signs of overheating, fuel saturation, or other damage.

(6) Discard and replace the preformed packings and the grommet. The solenoid cap washer may be reused if it is not damaged, deformed or fuel-soaked.

d. Reassembly and Installation.

(1) Install a new grommet (11, fig. 4-12) over the insulated solenoid coil lead, and slide the grommet into the slot in the solenoid cap (10).

(2) Install the coil housing (14) and solenoid coil (13) on the carburetor (15). Be sure the braided solenoid lead is centered over the tapped hole in the core which protrudes from the side of the carburetor. Install the washer (12) and solenoid cap (10), and secure with screw (8) and lock washer (9).

(3) Install the fuel heater (7) in the carburetor, with the leads toward the burner end of the carburetor.

(4) Install the preheat thermostat (5) on the carburetor and secure with the two screws (3) and lock washers (4).

(5) Install a new preformed packing (2) in the groove on the fuel adjustment needle (1). Apply a few small drops of Eastman No. 910 adhesive, or equivalent, to the side of the groove toward the point of the needle and press the preformed packing into the adhesive. After the adhesive sets, coat the preformed packing and the needle groove with Aircraft Grease, fuel and oil resistant per Military Specification G27617, or equivalent, and install the assembled needle and preformed packing in the carburetor. Tighten the adjustment needle gently until it just bottoms in the carburetor, then back it out two full turns to provide a preliminary fuel adjustment.

(6) Clean the groove that retains the preformed packing (6) on the carburetor. Install the preformed packing in the groove, and coat the packing with Aircraft Grease, fuel and oil resistant per Military Specification G27617, or equivalent.

(7) Install the assembled carburetor in the burner head and secure with the four screws (24, fig. 4-10) and lock washers (25).

(8) Coat the male NPT threads of the elbow (23) with Permatex No. 1, or equivalent, and install the elbow in the top of the carburetor. Slide the tube (22) over the straight end of the overflow tube (21) and install on the burner head. Connect the other end of the overflow tube to the elbow (23).

(9) Coat the male NPT threads of the elbow (15) with Permatex No. 1, or equivalent, and install in the carburetor fuel inlet. Connect the fuel tube (14) to the elbow.

(10) Install the top and side cover panels. Connect the fuel supply and power plug, start the heater, and check operation. Adjust the fuel adjustment needle.

Section IX. MAINTENANCE OF ELECTRICAL SYSTEM

4-24. Description.

a. Thermocouple. The thermocouple helps to control heater operation. Once the burner is lighted, heat from the burning fuel heats the end of the thermocouple which projects into the heat exchanger. This heat generates a small current in the thermocouple. The other end of the thermocouple is connected to the thermocouple relay (flame switch S3), and this small current which is generated energizes the relay coil, closing the relay contacts.

b. Room Thermostat. The room thermostat mounts on a wall in the heated enclosure. It is connected to the heater by a three-wire cable which plugs into the front of the heater. The thermostat senses the temperature of the air in the enclosure and turns the heater on and off, as long as the ON-OFF switch is on and the heater is supplied with fuel.

c. Blower Motor. The blower motor provides both combustion air to support the burning of fuel in the burner head, and ventilation air to heat the enclosure. The motor has an internally mounted thermal overload protector to shut it off in the event of overheating. You can replace the motor brushes without removing the motor from the heater case.

4-25. Description of Electrical System Operation.

a. Startup.

(1) When the operator turns the ON-OFF switch S1 (fig. 1-3) to ON, and if the room thermostat contacts are closed, current flows through control relay K2 to the glow plug G1 to heat the combustion chamber, and to timer heater S7 to begin the time delay cycle.

(2) With S1 closed, power is also available at fuel preheat thermostat S6 to heat the carburetor body if the ambient temperature is below 40°F (4°C).

b. Transition.

(1) The time delay switch S8 is open at room temperature. Heat from timer heater S7 causes switch S8 to close after a delay of 30 to 35 seconds at room temperature to as long as 2.5 minutes at -50°F (-45°C).

(2) When the time delay switch closes, it sends current to ignition power supply T1 to start the spark in the igniter, and to the fuel pump L2. Solenoid L1 is also energized and it opens a valve to start the flow of fuel into the burner head.

(3) The time delay switch S8 energizes the blower motor B1 through the control relay jumper wire to start the flow of combustion air into the burner head.

(4) The glow plug G1 and the timer heater S7 remain energized.

(5) The combination of heat from the glow plug and spark from the igniter make possible fuel ignition.

c. Run (Burner Lighted).

(1) If ignition proceeds normally in the transition stage, the heater lights, and heat from the burner is detected by the thermocouple which actuates the thermocouple relay (flame switch S3), closing the relay contacts.

(2) When flame switch S3 closes, it energizes control relay K2. When control relay K2 is energized, it disconnects time delay heater S7 and bypasses the time delay switch S8.

(3) When energized, the control relay also sends power to the ignition power supply, fuel pump, and blower motor. With the time delay circuit disconnected, the glow plug and timer heater shut off and cool, but the flame in the burner is sustained as long as fuel is supplied.

d. Ignition Failure.

(1) If the burner fails to light for any reason, the thermocouple will not actuate the thermocouple relay, and the contacts will not close. Control relay K2 will not energize to operate it in the run stage described in subparagraph *c*, above.

(2) In this situation, the glow plug and timer heater will temporarily remain energized. After a total of 60 to 70 seconds, heat from the timer heater will trip RESET switch S2 to shut off all power to the heater to prevent damage to the glow plug or to the time delay mechanism.

(3) If the heater runs out of fuel, or if the fuel flow stops for any reason, the thermocouple and relay will also act to shut off the heater when the heat exchanger cools.

e. Thermostatic Control.

(1) When ON-OFF switch S1 is turned on, the thermostat will operate the heater automatically to control room temperature. When the room temperature reaches the thermostat setting, the thermostat contacts open, starting the shutdown stage of the heater cycle.

(2) When the room temperature falls below the thermostat setting, the thermostat contacts close, causing the heater to enter the startup stage of its cycle.

(3) The thermostat will continue to turn the heater on and off to control room temperature as long as fuel and power are available to the heater.

f. Shutdown.

(1) When the operator turns ON-OFF switch S1 to OFF, or when the thermostat contacts open, the ignition and fuel pump power circuits are broken, stopping ignition and fuel flow.

(2) Power is still available to thermocouple relay (flame switch S3) to keep control relay K2 energized. Power is thus available to the relay to run blower B1 until all fuel in the burner is consumed. When the flame extinguishes, the blower circulates air to cool the heater.

(3) Air from the ventilation and combustion impellers cools the heat exchanger until the thermocouple reaches its cutout setting. The thermocouple relay contacts open, deenergizing control relay K2. This shuts off power to the blower and prepares the heater for the next startup.

g. Overheat.

(1) If the heater overheats because of reduced ventilation air flow, excessive fuel flow, or other causes, overheat thermostat S5 opens. This breaks the flow of current to the fuel pump and carburetor solenoid valve, shutting off the flow of fuel.

(2) Current still flows through control relay K2 to operate the blower, cooling down the heat exchanger. When the heat exchanger temperature reaches a safe level, the overheat switch closes to restart fuel flow and ignition. Because the heat exchanger and burner head are still quite warm, ignition is rapid and the glow plug and time delay assembly are not utilized.

4-26. Thermocouple.

a. Removal.

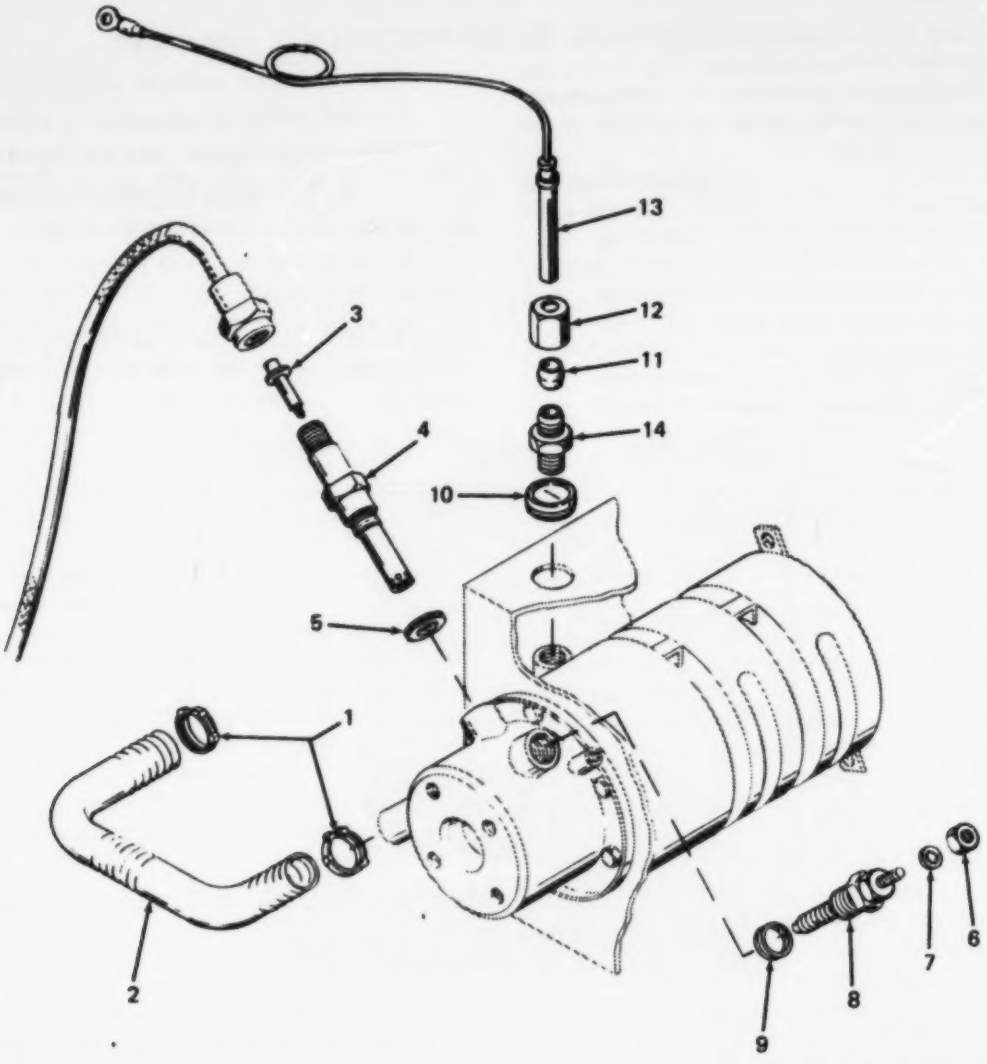
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and remove the top and side cover panels and warm air louver to provide access to the thermocouple and its connection at the thermocouple relay.

(2) Disengage the grommet (10, fig. 4-13) from the hole in the heat exchanger housing. Unscrew the compression nut (12) on the thermocouple (13) and remove the assembled compression sleeve (11), compression nut, and thermocouple (13) from the heat exchanger. Slide the grommet (10) from the thermocouple. Do not attempt to disassemble the compression sleeve, nut, and thermocouple.

(3) Remove the connector bolt at the top of the thermocouple relay. Disconnect and remove the thermocouple lead from the relay.



1. Hose clamp
2. Combustion air hose
3. Waterproof connector
4. Igniter
5. Gasket
6. Nut
7. Lock washer
8. Glow plug
9. Gasket
10. Grommet
11. Compression sleeve
12. Compression nut
13. Thermocouple
14. Adapter

Figure 4-13. Burner head components, exploded view.

b. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Clean the thermocouple and lead with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680).

(2) Remove combustion deposits from the sensor end of the thermocouple with a fine-grit stone or sandpaper. Replace the thermocouple if the sensor end is bent, burned, or severely corroded, if the lead is kinked or broken, or if the terminal is distorted or damaged.

c. Installation.

(1) If a new thermocouple is being installed, slide the compression nut (12, fig. 4-13) and compression

sleeve (11) onto the thermocouple (13), and insert the thermocouple into the heat exchanger. Tighten the nut to seat the compression sleeve onto the thermocouple.

(2) Install the grommet (10) into the hole in the heat exchanger housing.

(3) Form the thermocouple lead to make a loop and then connect the end of the lead to the thermocouple relay.

(4) Install the warm air louver (fig. 4-4) and top and side cover panels. Connect the power plug and check heater for proper operation.

4-27. Motor Brushes.

a. Removal.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and remove the top and side cover panels.

(2) Refer to figure 4-14, and remove the motor brush caps. Remove the motor brushes from the brush holders.

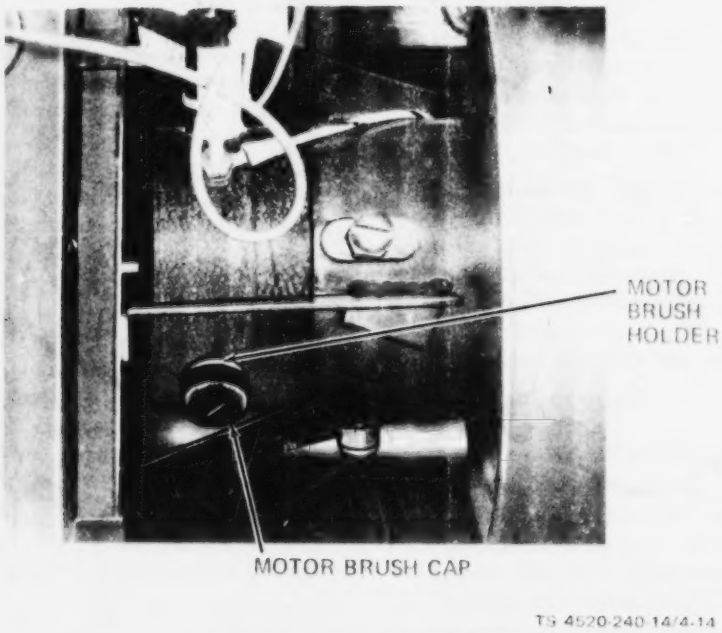


Figure 4-14. Motor brush installation.

b. Inspection.

(1) Inspect the wear faces of the brushes for signs of scoring, uneven wear, burning, pitting, or other damage. Scored or unevenly worn brushes indicate that the motor armature is defective. Report the condition to direct support maintenance.

(2) Replace the brushes if the brush lead is broken, or if the brushes are worn to less than 5/16 inch long.

c. Installation.

(1) Align the curve of the brush wear face with the curvature of the motor armature commutator, and install the brushes in the brush holders. Reinstall the brush caps.

(2) Reinstall the top and side covers and connect the power plug. Start the heater and check for proper operation.

4-28. Room Thermostat.

a. Check the thermostat operation by operating the knob (fig. 2-2) from one extreme to the other, checking that electrical continuity is made as the knob position indicates room temperature and below, and that continuity is broken above room temperature.

b. No repair is authorized for the room thermostat. Replace a defective thermostat.

c. The thermostat may be cleaned by removing the cover and wiping away accumulations of dust and lint with a soft-bristle brush. Check that all wiring connections are tight and reinstall the cover.

Section X. MAINTENANCE OF BURNER ASSEMBLY

4-29. Description.

a. Air Inlet Hose. On Model UH-48-C, the air inlet hose is a spring-wound, neoprene-coated tube. On Model UH-48-D, the air inlet hose is a paper-aluminum-paper laminated tube. The air inlet hose conducts combustion air from the combustion air inlet on the burner head.

b. Igniter. The igniter is similar to an automotive spark plug, and it performs a similar function. High voltage from the ignition power supply creates a spark between the igniter electrode and the grounded igniter sleeve that surrounds the electrode. It is this spark which ignites the fuel and air mixture in the burner head.

c. Glow Plug. The glow plug is energized only while the heater is being started. The glow plug is a wire wound electrical heater that preheats the burner head to ensure vaporization of the fuel for rapid ignition.

d. Burner Head. The burner head provides mounting for the carburetor, igniter, and glow plug, and contains a small combustion chamber. Air from the combustion air blower enters the burner head through the combustion air hose, and mixes with the fuel metered by the carburetor. Spark from the igniter ignites the fuel and air mixture inside the burner head. The burning gases pass through the heat exchanger, which heats ventilation air flowing around it, and exit the heater through the exhaust pipe.

4-30. Igniter, Glow Plug, and Combustion Air Hose.

a. Removal.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and remove the top and side cover panels to provide access to the burner head.

(2) Loosen the two clamps (1, fig. 4-13) securing the combustion air hose (2) to the combustion air blower outlet and the burner head. Remove the combustion air hose, and remove the clamps from the hose.

(3) Unscrew the nut on the ignition cable (4, fig. 4-7) and remove the cable and the waterproof connector (3, fig. 4-13). Unscrew the igniter (4) and remove the igniter and the gasket (5) from the burner head.

(4) Remove the nut (6) and lock washer (7) and disconnect the blue lead from the glow plug (8). Unscrew and remove the glow plug and the gasket (9) from the burner head.

b. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

(1) Clean the igniter, the glow plug, and the outside of the burner head with dry cleaning solvent (fed. spec. P-D-680). Do not immerse the glow plug in solvent or allow solvent to enter the burner head. Allow all parts to dry thoroughly before installation.

(2) Inspect the electrode and outer shell of the igniter for burning or pitting. Inspect ceramic parts for cracks or breaks. Inspect threads for damage. Replace a damaged igniter.

(3) Inspect the glow plug for cracks, frayed insulation, loose or broken leads, defective element winding, and other damage. Apply 28 vdc across the glow plug leads and check that the glow plug heats. Replace a damaged or defective glow plug.

(4) Clean the combustion air hose by shaking it or blowing through it with compressed air. Replace the hose if it is torn, deteriorated, restricted, or damaged.

(5) Inspect the ignition cable for cracks, deterioration, fraying, and other damage. Report a defective cable to direct support maintenance.

(6) Report a damaged or defective burner head to direct support maintenance for repair.

(7) Discard and replace the gaskets.

c. Installation.

(1) Install the glow plug (8, fig. 4-13) and igniter (4) in the burner head, using new gaskets (5 and 9). Connect the blue glow plug lead using nut (6) and lock washer (7). Insert the waterproof connector (3) on the ignition cable and connect the ignition cable to the igniter.

(2) Slide the clamps (1) over the ends of the combustion air hose (2), and fit the hose over the combustion air blower outlet and the burner head air inlet. Tighten the clamps.

(3) Reinstall the top and side cover panels, connect the power plug, and test the heater operation.

CHAPTER 5
DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. Tools and Equipment.
The equipment issued with the heater assembly is illustrated in figure 1-1.

5-2. Special Tools and Equipment.
No special tools or equipment is required for direct support or general support maintenance of the heater assembly.

5-3. Maintenance Repair Parts.
Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct support and general support maintenance for this equipment. Refer to TM 5-4520-240-24P.

Section II. TROUBLESHOOTING

5-4. General.
a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the space heater. Each malfunction is followed by a list of tests or inspections which will help you determine probable causes and corrective actions to take. Perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor. Only those functions which are solely within the scope of direct support and general support maintenance are listed.

5-5. Direct Support and General Support Maintenance Troubleshooting Chart.
Refer to table 5-1 for troubleshooting which is allocated to direct support and general support maintenance levels.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity tests.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 5-1. Direct Support and General Support Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).
Step 1. Remove top and side cover panels, and pull out control panel. With power connected, turn the heater on and check that the time delay assembly heats. **Replace the time delay assembly (para 6-2 thru 6-4) if it fails to become noticeably warm within 45 to 70 seconds.**
Step 2. With power on, briefly jumper yellow and green leads on terminal block. **If blower begins to run, replace the time delay assembly (para 6-2 thru 6-4).**
Step 3. Disconnect power plug and allow time delay assembly to cool. Press RESET button and check continuity between two red leads using an ohmmeter. **Replace the time delay assembly if the switch is open after reset (para 6-2 thru 6-4).**
Step 4. Check control relay continuity using an ohmmeter (para 7-3). **Replace a defective control relay (para 7-2 thru 7-4).**
Step 5. Check ignition power supply for high voltage output. **Repair or replace ignition power supply (para 8-2 thru 8-4).**
2. HEATER IGNITES BUT BLOWER FAILS TO RUN.
Step 1. Turn power on, wait for time delay, and check for 28 vdc across motor terminals using a multimeter set to read dc voltage. **Replace control relay if there is no power for motor terminals. Refer to paragraph 7-2 thru 7-4.**
Step 2. Disconnect motor leads at plug in connector and motor ground terminal. Connect to external source of 28 vdc. **Replace motor if it fails to run.**

Table 5-1. Direct Support and General Support Troubleshooting — Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
3. HEATER OVERHEATS.	
Step 1. Disconnect power plug and remove top and side cover panels. Check that the ventilation air impeller is tight on the motor shaft, and not damaged.	
Tighten the impeller, or replace it if defective (para 10-2 thru 10-4).	
Step 2. Connect power plug, start heater, and observe blower operation with cover panels removed.	
Repair blower motor if motor runs slowly or vibrates due to defective bearings, or if the motor protector switch S4 (fig. 1-3) trips out. Refer to paragraphs 10-2 thru 10-4.	

CHAPTER 6
REPAIR OF CONTROL PANEL

6-1. Description.

The following control panel components help control heater operation:

a. Time Delay Assembly. The time delay assembly consists of the timer heater S7 (fig. 1-3), RESET switch S2, and the time delay switch S8.

(1) The timer heater is energized when the ON-OFF switch S1 is turned on, and it heats both the time delay switch and the RESET switch.

(2) The time delay switch S8 is normally open, until heat from the timer heater S7 closes it. The time required for the timer heater to trip the time delay switch is longer than the time required by the glow plug to preheat the burner head to ensure rapid fuel ignition.

(3) When the time delay switch finally closes from the heat of the timer heater S7, it energizes the ignition power supply T1 and the fuel pump L2, starting ignition, fuel flow to the burner head, and the blower motor.

(4) If ignition proceeds normally, the contacts of the thermocouple relay (flame switch) S3 close, energizing the control relay K2. This disconnects the timer heater, allowing it to cool down, and bypasses the time delay switch.

(5) The RESET switch S2 is normally closed. If the burner does not ignite, the timer heater will continue to heat the RESET switch to its opening point. When the RESET switch opens, it shuts off all power to the heater. The RESET switch requires manual reset.

b. Receptacles. The THERMO and POWER receptacles are mounted on the control panel to provide connections to the room thermostat and to the 28 vdc power source to operate the heater.

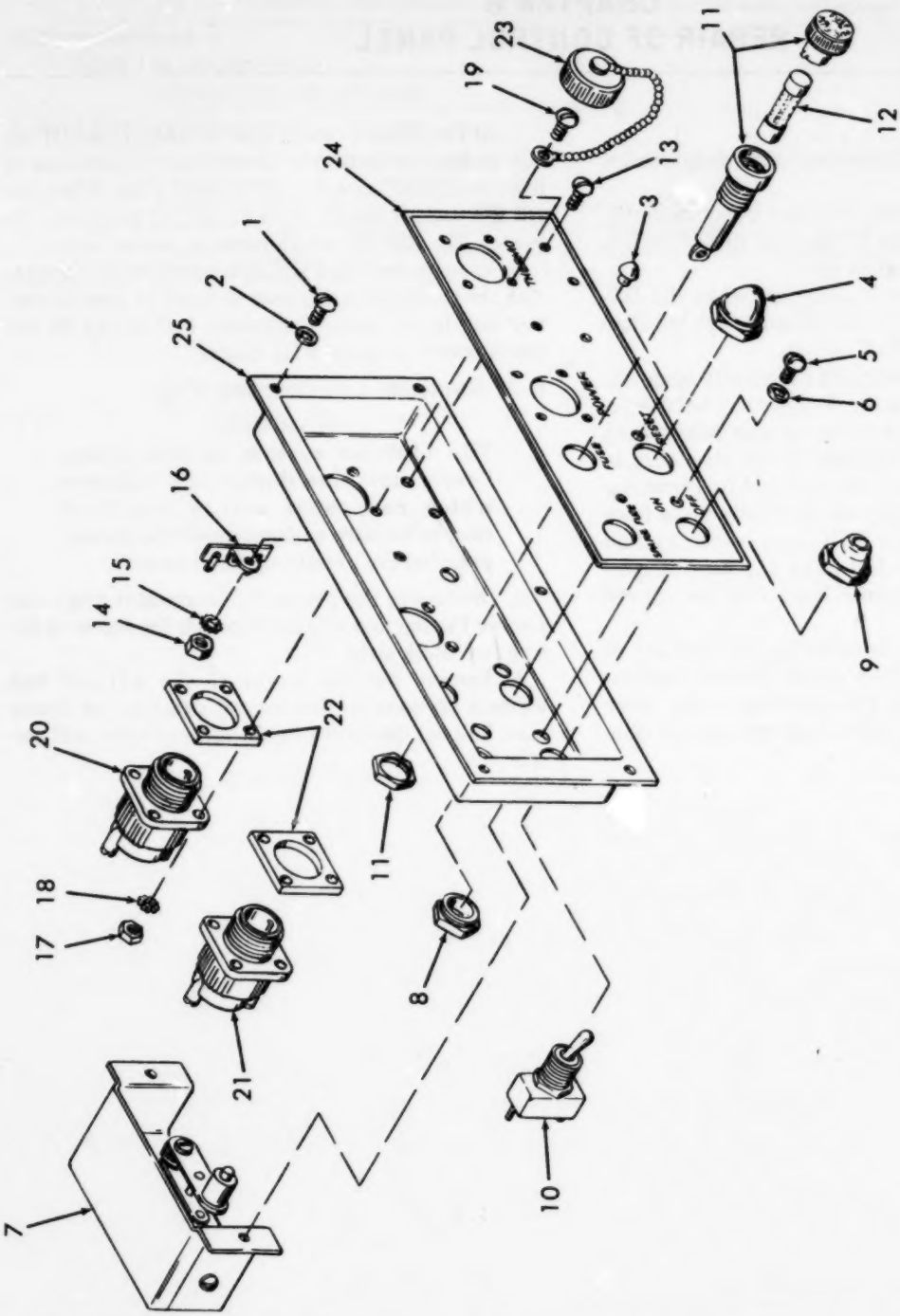
6-2. Removal and Disassembly.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power and thermostat plugs and remove the top and side cover panels for access to the terminal block strip.

b. Remove the five screws (1, fig. 6-1) and lock washers (2) securing the control panel to the heater case. Pull out the control panel as far as wires will permit.



c. Disconnect the time delay assembly leads at terminal block TB1 (fig. 1-4), and unsolder the leads at terminal block strip (16, fig. 6-1), fuseholder F1, ON-OFF switch S1, and thermostat receptacle J2. Remove bumpers (3). Unscrew the boot (4) and remove it from the RESET switch. Remove the two screws (5) and lock washers (6) securing the time delay assembly (7) to the control panel; remove the time delay assembly remove nut (8).

d. If the ON-OFF switch (10) is defective, tag ar solder the two red and two violet leads from the sw Refer to the wiring diagram (fig. 1-4). Unscrew the (9) and remove the ON-OFF switch from the back control panel.

e. Push in the cap on the fuseholder (11) and rotate the cap counterclockwise to remove it from the fuseholder. Remove the fuse (12) from the fuseholder. Tag and unsolder the two red wires from the fuseholder. Remove the fuseholder nut and pull the fuseholder from the front of the control panel. Remove the spare fuseholder the same way.

f. If the terminal block strip (16) must be replaced, unsolder the remaining leads. Remove the screw (13), nut (14), and lock washer (15) securing the terminal block strip to the control panel, and remove the terminal block strip.

g. To remove the receptacles (20 and 21), remove the nuts (17), lock washers (18), and screws (19), and remove the receptacles and gaskets (22) from the control panel (25). Unscrew the retainer from the rear of the receptacle and pull out the plug to provide access to the lead-to-pin connections. Unsolder the pins from the leads and remove the receptacles.

h. When control panel components have been removed, you can separate the panel plate (24) from the control panel (25) for cleaning and replacement.

6-3. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

a. Clean parts with a dry soft-bristle brush. Remove greasy or gummy deposits with a cloth dampened lightly in dry cleaning solvent (fed. spec. P-D-680).

b. Inspect leads and components for worn or broken insulation, signs of overheating, or other defects. Replace defective parts.

c. Visually inspect the heating element and contact points in the time delay unit. Replace the complete unit if the points are burned or pitted, or if the heating element is damaged. Use an ohmmeter to test continuity. There must be continuity between the blue lead and the white-black lead, and between the two red leads. There must be no continuity between the green and yellow leads, or any other pair of leads, or between any lead and the time delay assembly housing. Replace the time delay assembly if these requirements are not met.

NOTE

If the time delay assembly has not been removed from the control panel, the yellow, blue, and green leads must be disconnected from the terminal block before the continuity test is performed.

d. Replace the boot (4, fig. 6-1) if it will not form a tight seal around the RESET switch. Replace gaskets (22).

e. Inspect all wiring for frayed or broken insulation. Replace damaged leads. Replace the terminal block if its insulation is cracked or broken.

6-4. Reassembly and Installation.

a. Install the components on the control panel in the reverse order of the index numbers in figure 6-1.

b. When installing the THERMO and POWER receptacles (20 and 21) on the control panel, slide the plug and retainer over the ends of the leads before soldering the leads to the pins in the other segment of the receptacle. Make sure the wire color will be correct when the key in the plug is inserted in the keyway on the receptacle housing. Slide the plug into the housing to cover the soldered connections and secure by installing the retainer.

c. Use the wiring diagram (fig. 1-4) as a guide when installing the leads on the components.

d. Install the control panel in the front of the heater case and secure with five screws (1, fig. 6-1) and lock washers (2).

e. Reinstall the top and side cover panels, connect the power and thermostat plugs, and test heater for proper operation.

Figure 6-1. Control panel components, exploded view.

CHAPTER 7
REPAIR OF ELECTRICAL CONTROL COMPONENTS

7-1. Description.

a. The electrical components which control automatic heater operation, and which are not mounted on the control panel, include the control relay K2, thermocouple relay (flame switch) S3, and overheat thermostat S5. A terminal block TB1 is provided to facilitate making electrical connections.

b. The control relay (10, fig. 4-7) is mounted on the heater housing next to the control panel. This double-pole, double-throw relay is energized through the thermocouple relay to switch heater operation from the start mode to the run mode when the presence of flame is sensed by the thermocouple.

c. The thermocouple relay (9, fig. 4-8) is connected to the thermocouple by means of the thermocouple lead (13) which is part of the thermocouple. The thermocouple extends into the heat exchanger and, when the fuel is ignited, the flame heats the thermocouple and generates a small current. This current trips the thermocouple relay which, in turn, energizes the control relay to change heater operation from the start mode to run mode.

d. The overheat thermostat is mounted on a bracket attached to the heat exchanger. The thermostat is normally closed. At a temperature of 250° ±6°F (118° to 124°C), the thermostat opens. The thermostat is connected into the fuel solenoid circuit so that when an excessive temperature is reached, the fuel solenoid valve will deenergize to stop combustion. As the thermostat cools to 210° ±12°F (92° to 105°C), the circuit will again be energized and the fuel solenoid will again open the fuel valve to reestablish combustion.

e. A terminal block (11, fig. 4-7) is mounted on the bottom of the heater housing to help facilitate electrical connections to the various components of the heater. Connector tabs are installed on the terminal block to permit making multiple slip-on type connections to the terminals of the block.

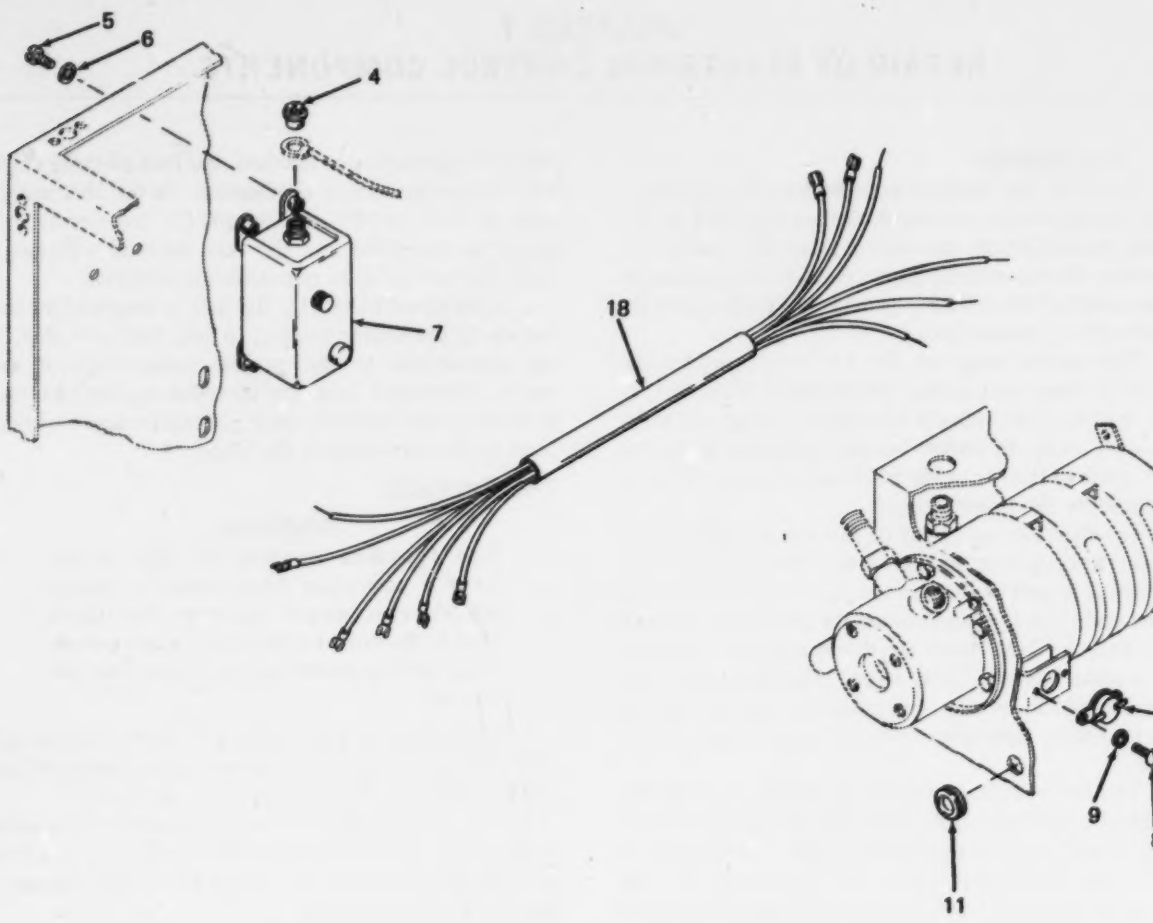
7-2. Removal.

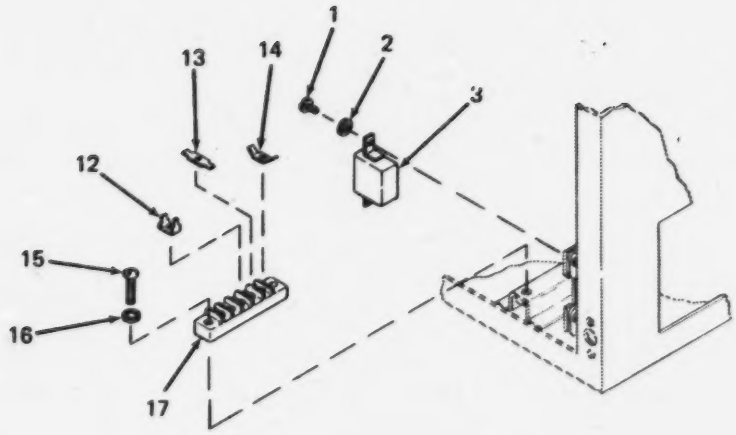
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

a. Disconnect the power plug and remove the top and side cover panels to provide access to the electrical control components. Remove the warm air louver.

b. Tag and unsolder the electrical leads to the control relay (3, fig. 7-1). Remove the two screws (1) and lock washers (2) that secure the control relay to the housing; remove the control relay.





TS 4520-240-1

1. Screw
2. Lock washer
3. Control relay
4. Connector bolt
5. Screw
6. Lock washer
7. Thermocouple relay
8. Screw
9. Lock washer
10. Overheat thermostat
11. Grommet
12. Tab
13. Tab
14. Tab
15. Screw
16. Lock washe
17. Terminal b
18. Wiring har

Figure 7-1. Electrical control components, exploded view.

c. Unscrew the connector bolt (4) and disconnect the thermocouple lead from the thermocouple relay (7). Remove the cover from the relay, and tag and disconnect the electrical leads from the relay. Remove the four screws (5) and lock washers (6), and remove the thermocouple relay from the housing.

d. Disconnect the orange and green leads from the overheat thermostat (10). Remove the two screws (8) and lock washers (9), and remove the overheat thermostat from the bracket on the heat exchanger.

e. Tag and disconnect the electrical leads from the terminal block (17) and from the tabs (12, 13, and 14) on the terminal board. Remove the two screws (15) and lock washers (16) and remove the terminal block from the bottom of the heater housing.

f. Remove the wiring harness (18) if the wires are frayed, burned, or have defective insulation.

7-3. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

a. Wipe the components with a clean, dry cloth. Dampen the cloth with dry cleaning solvent (fed. spec. P-D-680) if necessary to remove greasy or gummy deposits. Do not saturate the electrical components.

CAUTION

The control relay is designed for 28-volt operation only. Voltage in excess of 28 volts may destroy the relay coil (terminals X1 and X2).

NOTE

The control relay must be disconnected from the heater circuits before performing continuity tests. Alternate circuit paths within the heater will confuse the test results.

b. Replace the control relay (3, fig. 7-1) if the case is damaged, or if the relay shows signs of overheating or arcing. Test the resistance of the relay coil with an ohmmeter. The resistance across terminals X1 and X2 (shown in fig. 7-2) must be 300 ± 30 ohms. There must be continuity only between terminals B2 and B3, and between A2 and A3, but no continuity across B1 and B2, or across A1 and A2. Replace the relay if it does not operate as specified.

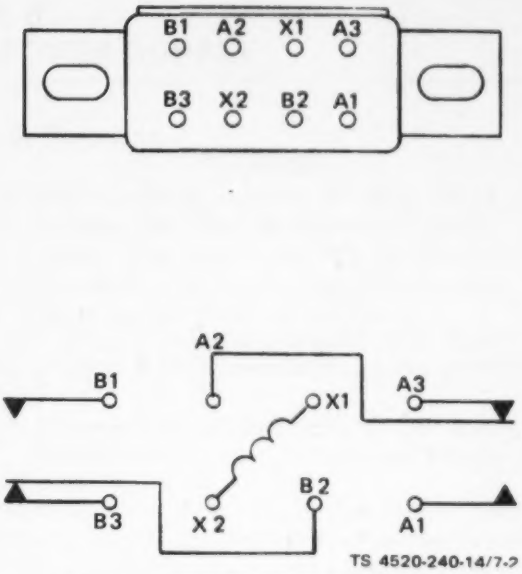


Figure 7-2. Control relay terminal identification.

c. To test the thermocouple relay, connect the thermocouple to the relay and, using a cigarette lighter or small torch, heat the sensor end of the thermocouple while checking the continuity across the relay. When the thermocouple is cool, no continuity should exist across the normally open (N.O.) controls of the relay. When the thermocouple is heated, continuity must be established across these relay contacts. Replace a defective thermocouple relay.

d. Inspect the overheat thermostat for damaged terminals, broken insulation, or other damage. There must be continuity across the overheat thermostat terminals at room temperature, and up to a temperature of 250° ±6°F (118° to 124°C). Replace the thermostat if it is open below this temperature range, or if it is still closed above 256°F (124°C). When cooling, the thermostat must reopen at 210° ±12°F (92° to 105°C). Replace a defective thermostat.

e. Inspect the terminal block for cracks, burned or damaged terminals, and missing terminal screws. Replace a damaged terminal block.

f. Inspect the wiring harness for loose or broken terminals, frayed or damaged insulation, or burned wires. Replace a defective wiring harness.

7-4. Installation.

a. Install the control relay, thermocouple relay, overheat thermostat, and terminal block by reversing the removal and disassembly procedure. Refer to figure 7-1.

b. After installation, install the side and top cover panels and insert the power plug. Check the operation of the heater. Correct any defective operation.

CHAPTER 8
REPAIR OF IGNITION POWER SUPPLY

8-1. Description.

a. The ignition power supply (12, fig. 4-7) is mounted in the bottom of the heater housing. It converts 28 vdc input to the high voltage output necessary to provide a hot spark at the igniter in the burner head. This spark is necessary to ignite fuel vapors to start combustion. A shielded high voltage cable connects the secondary of the power supply to the igniter.

b. The ignition power supply employs two transistors which provide a pulsating current in the primary coil to induce a continuous voltage step-up in the secondary coil. The coils are potted in the transformer box and are not replaceable. All components of the power supply are mounted in the box except the transistors. The transistors are mounted on the box cover to provide better heat dissipation.

8-2. Removal.

WARNING

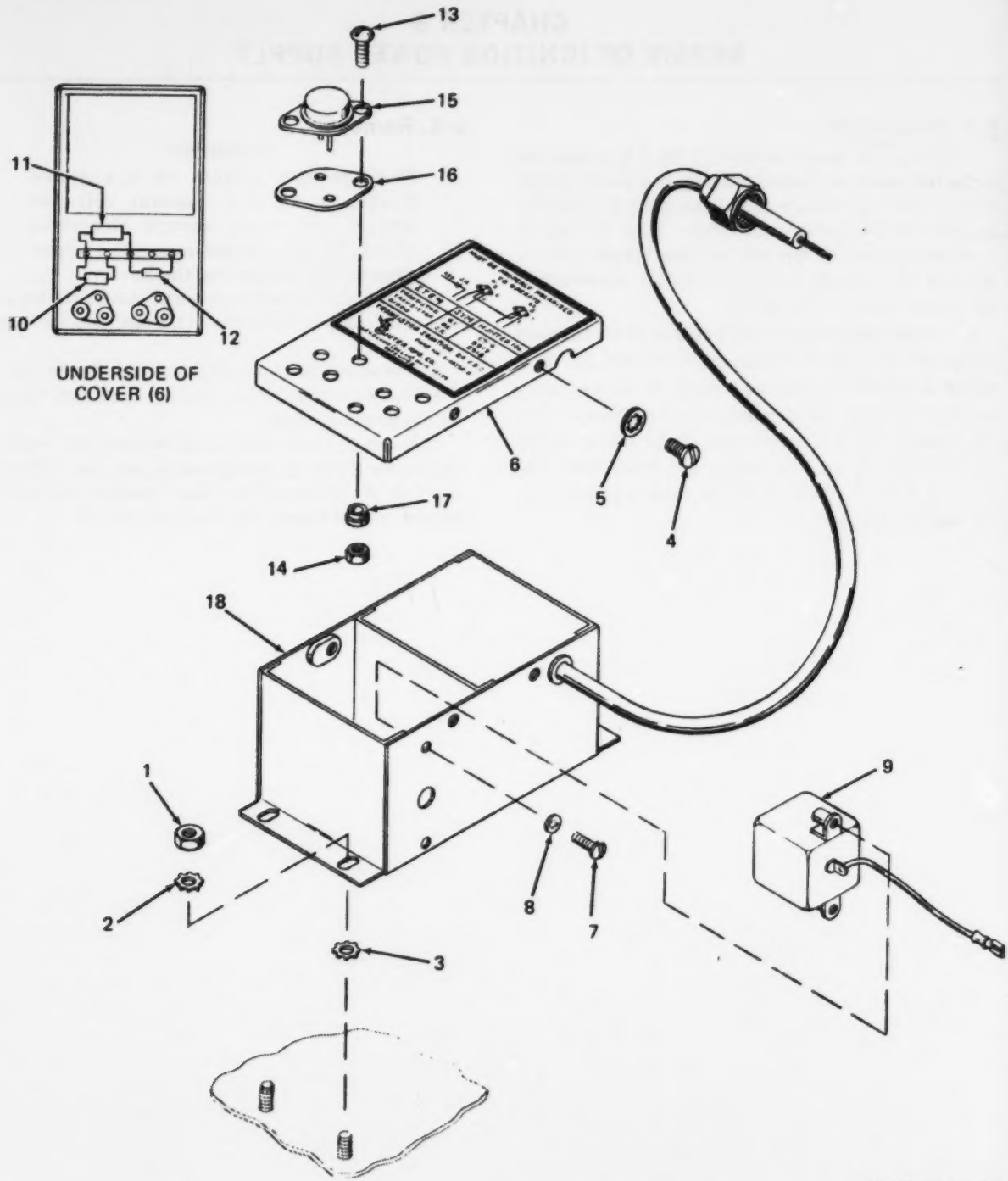
The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power plug and remove the top and side panels to provide access to the ignition power supply.

b. Disconnect the ignition cable from the igniter.

c. Disconnect the yellow primary lead from the tab on the terminal block.

d. Remove the two nuts (1, fig. 8-1) and lock washers (2) that secure the ignition power supply case (18) to the studs on the bottom of the heater housing; remove the ignition power supply and lock washers (3).



TS 4520-240-14/8-1

1. Nut
2. Lock washer
3. Lock washer
4. Screw
5. Lock washer
6. Cover
7. Screw
8. Lock washer
9. Filter (FL1)
10. Resistor (R1)
11. Resistor (R2)
12. Diode (CR1)
13. Screw
14. Nut
15. Transistor
16. Insulator
17. Insulating washer
18. Case

Figure 8-1. Ignition power supply installation, exploded view.

NOTE

Do not replace the following parts unless they are found to be defective following the cleaning and inspection procedures described in paragraph 8-3.

e. If the filter (9) must be replaced, disconnect the yellow lead from the terminal block and unsolder the red lead from the terminal strip on the cover (6). Remove the screws (7) and lock washers (8), and remove the filter from the power supply case (18).

f. To remove the resistors (10 and 11) and diode (12), unsolder them from the terminal strip on the cover (6).

g. If the transistors (15) must be replaced, remove the screws (13) and nuts (14) securing each transistor to the cover (6). Unplug the transistors and remove them and the insulators (16) from the cover. The insulating washers (17) need not be replaced unless they are defective.

8-3. Cleaning and Inspection.

WARNING

Clean all parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

a. Wipe the exterior of the ignition power supply with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Take care to prevent solvent from entering the interior of the unit.

WARNING

The output of the ignition power supply is high enough to cause severe electrical shock. When testing, take care to prevent physical contact with bare end of the ignition cable.

CAUTION

When checking spark, do not allow the spark gap to exceed 1/8 inch. Greater gap will cause excessively high potential resulting in insulation breakdown either internally or in the ignition cable.

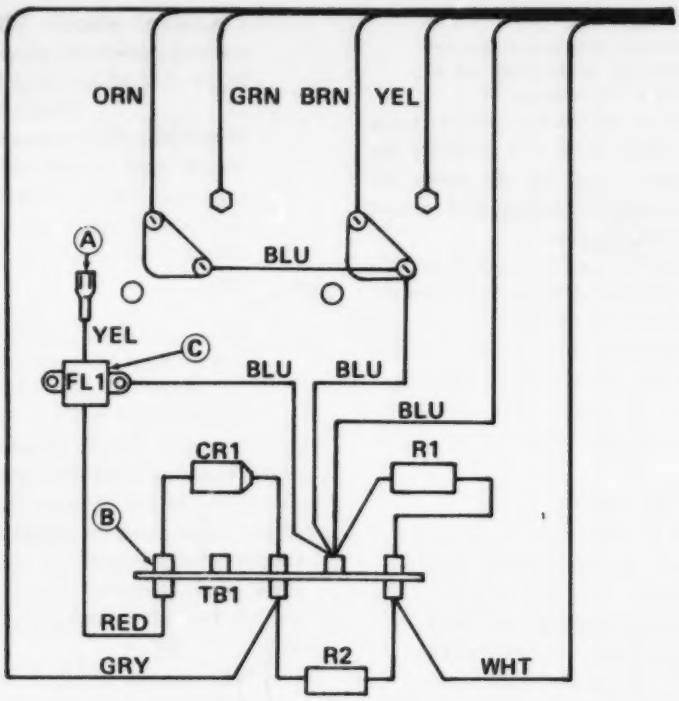
NOTE

When checking the ignition power supply, make sure that the input power is applied in the proper polarity. The unit will not operate when polarity is reversed.

b. To check the operation of the ignition power supply, connect it to a 28 vdc source of power. Connect the negative to an unpainted ground and connect the positive to the yellow primary lead. Hold the end of the ignition cable near an unpainted portion of the power supply case and check for a hot spark when power is applied to the primary circuit. If a hot spark does not jump across an 1/8-inch gap, the power supply is defective.

c. If the power supply fails to operate properly, disconnect it from the power source, remove the four screws (4, fig. 8-1) and lock washers (5) and lift off the cover (6) as far as the interconnecting wires will allow. This will provide access to the interior components. Use a multimeter to check resistances as follows:

(1) Check the resistance through filter FL1 (9). Refer to the ignition power supply wiring diagram, figure 8-2. Resistance from test point A to test point B must be 0 ohms. With the meter + probe at point A and - probe at point C, resistance must be infinite. With + probe at C and - probe at A, resistance must be 700 to 800 ohms. Replace the filter if it is open or grounded.



TS 4520-240-14/8-2

Figure 8-2. Ignition power supply wiring diagram.

NOTE

Resistors R1 and R2 and diode CR1 must be disconnected from the circuit for the following tests. Alternate circuit paths within the power supply will confuse the test results.

(2) Check the resistance of resistor R1 (10, fig. 8-1). Its resistance must be 47 ohms ±10 percent. Replace if defective.

(3) Check the resistance of resistor R2 (11). Its resistance must be 510 ohms ±5 percent. Replace if defective.

(4) Check resistance in both directions of diode CR1 (12). In flow direction, resistance must be approximately 24 ohms. Infinite resistance must be indicated in the reverse direction. Replace a faulty diode.

(5) If the above tests fail to indicate any defects, check transformer resistance between the tip of the ignition cable and ground. Resistance must be 700 ohms ±10 percent.

(6) If resistance through the secondary of the ignition transformer is incorrect, replace the transformer. If transformer resistance is within the required range, substitute transistors (15, fig. 8-1) one at a time, check for proper electrical output. Replace the de tive transistor.

(7) Secure the cover (6, fig. 8-1) to the igni power supply with four screws (4) and lock washers Recheck per step *b* above.

8-4. Installation.

a. Position two external tooth lock washers (3, 8-1) on the studs in the bottom of the heater hous Position the ignition power supply on the housing that the rear of the power supply engages the bra on the floor of the housing. Secure by installing nuts (1) and lock washers (2).

b. Connect the high voltage ignition cable to the niter on the burner head.

c. Connect the yellow lead to the tab on the term board to which the other yellow leads are connecte

d. Install the top and side covers and insert power plug into the POWER receptacle. Attemp start the heater and check for proper operation.

CHAPTER 9
REPAIR OF BURNER HEAD AND HEAT EXCHANGER

9-1. Description.

a. Burner Head. The burner head mounts on the end of the heat exchanger, and provides mounting for the igniter, glow plug, and carburetor. Combustion air supplied by the combustion air blower enters the burner head and passes into the burner head combustion chamber, where it mixes with the fuel from the carburetor. This mixture is ignited and burns within the burner head.

b. Heat Exchanger. The heat exchanger is a stainless steel cylinder with a large surface area. It is open to the burner head at one end, and contains an outlet for exhaust gases near the other end. The burning fuel and air mixture heats the walls of the heat exchanger. The ventilation air blower blows circulating air around the outside of the heat exchanger, where the air picks up heat from the heat exchanger before it passes through the warm air louver into the enclosure to be heated.

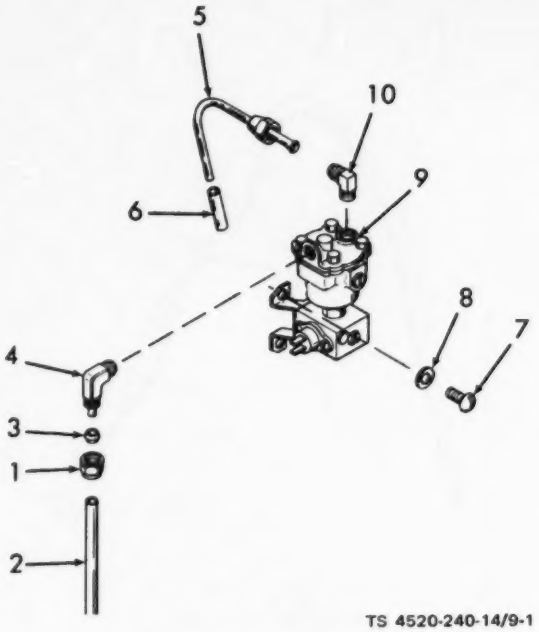
9-2. Removal and Disassembly.

WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power and thermostat plugs. Disconnect the fuel supply and the exhaust piping. Remove the top and side cover panels and warm air louver.

b. Disconnect the fuel preheat thermostat leads and the fuel solenoid leads. Disconnect the compression nut (1, fig. 9-1) of fuel tube (2) at the elbow (4) in the carburetor inlet. Disconnect the overflow tube (5) from the elbow (10) on the top of the carburetor (9). Remove the overflow tube and tube (6).



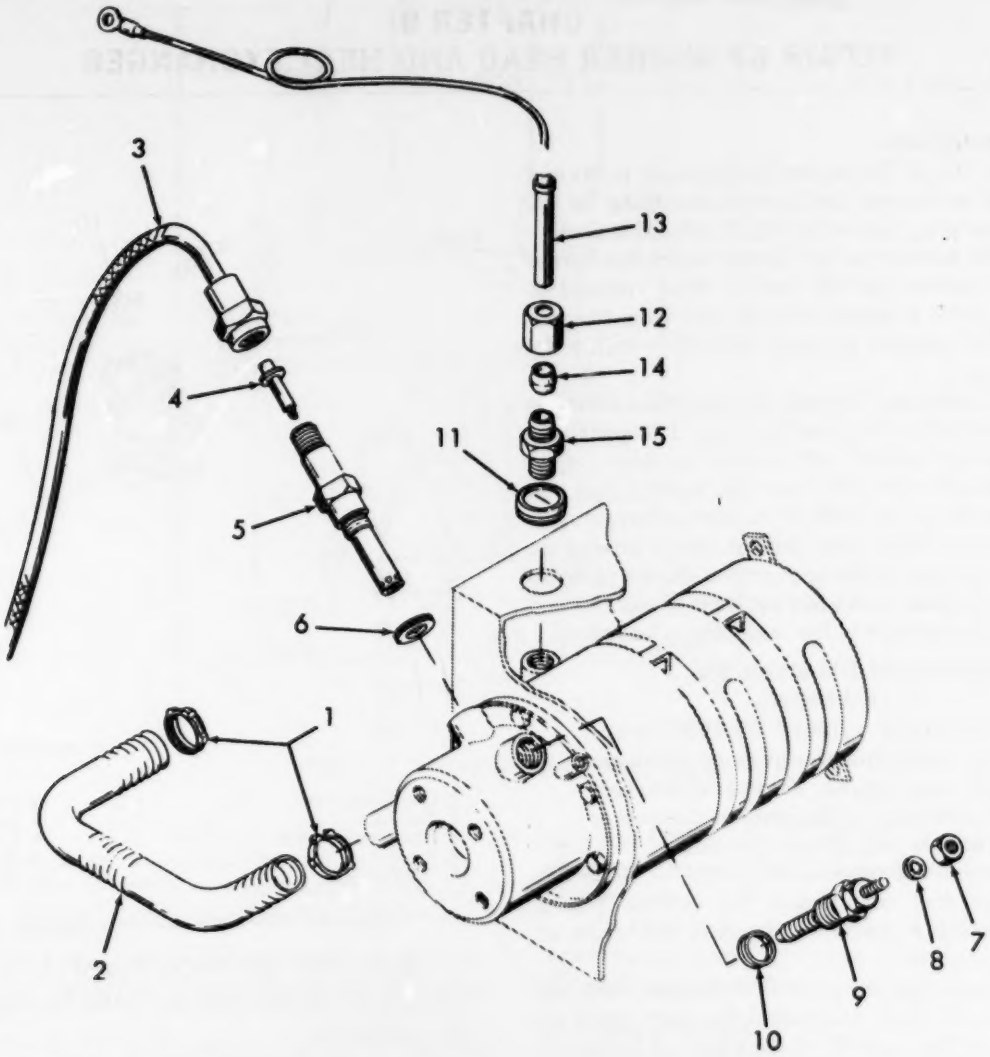
TS 4520-240-14/9-1

1. Compression nut
2. Fuel tube
3. Compression sleeve
4. Elbow
5. Overflow tube
6. Tube
7. Screw
8. Lock washer
9. Carburetor
10. Elbow

Figure 9-1. Carburetor installation, exploded view.

c. Remove the four screws (7) and lock washers (8) securing the carburetor to the burner head and remove the carburetor.

d. Loosen the hose clamps (1, fig. 9-2) and remove the combustion air hose (2) from the blower outlet and the burner head inlet.



1. Hose clamp
2. Combustion air hose
3. Ignition cable
4. Waterproof connector
5. Igniter
6. Gasket
7. Nut
8. Lock washer
9. Glow plug
10. Gasket
11. Grommet
12. Compression nut
13. Thermocouple
14. Compression sleeve
15. Adapter

Figure 9-2. Burner head components, exploded view.

e. Unscrew the nut on the ignition cable (3) and remove the cable and waterproof connector (4). Unscrew the igniter (5) and remove the igniter and gasket (6) from the burner head.

f. Remove the nut (7) and lock washer (8) and disconnect the blue lead from glow plug (9). Unscrew and remove the glow plug and the gasket (10) from the burner head.

g. Disengage the grommet from the hole in the heat exchanger housing. Unscrew the compression nut (12) on the thermocouple (13) and remove the assembled compression sleeve (14), compression nut, and ther mocouple from the heat exchanger. Unscrew an remove the adapter (15).

h. Use an Allen screw screwdriver to remove th screws (1, fig. 9-3) and lock washers (2) securing th burner head (3) to the heat exchanger housing (24 Remove the burner head and gasket (4).

i. Remove the overheat thermostat. Remove the nu (5), lock washers (6 and 8), and screw (7) securing th bracket (9) to the heat exchanger (22); remove th bracket.

j. Remove the four screws (10) and lock washers (11) securing the exhaust connection (12) to the heater case. Remove the exhaust connection, gasket (13), and exhaust washer (14).

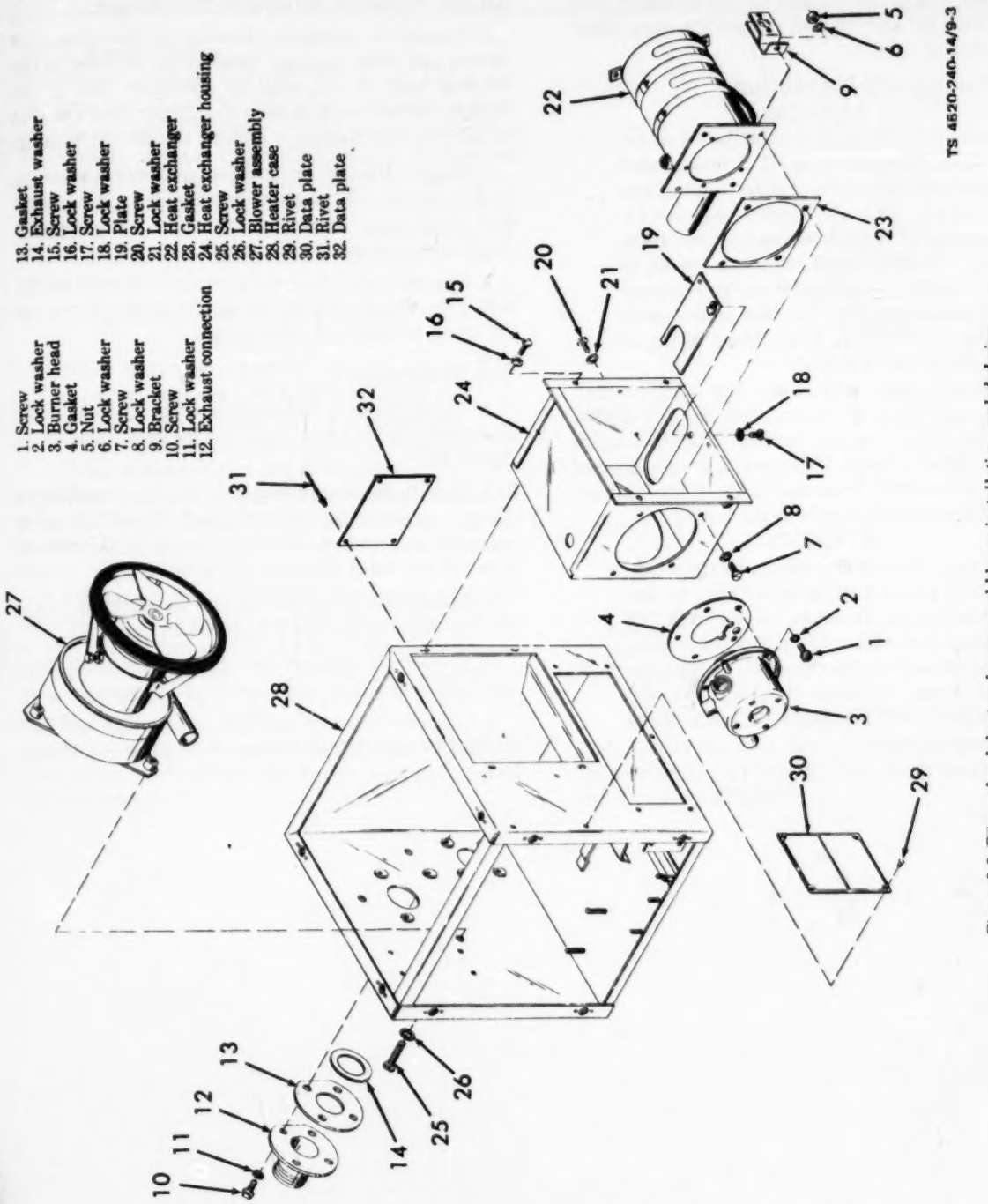


Figure 9-3. Burner head, heat exchanger, and blower installation, exploded view.

k. Remove the four screws (15) and lock washers (16) securing the heat exchanger housing (24) to the heater case (28). Pull out the assembled housing and heat exchanger to remove them from the case.

l. Remove the screw (17) and lock washer (18) from the underside of the heat exchanger housing (24), and remove the plate (19). Remove the five screws (20) and lock washers (21) securing the heat exchanger (22) to its

housing. Pull the heat exchanger up and out to remove it, and remove the gasket (23).

m. If the data plates (30 and 32) are damaged, drill out the rivets (29 and 31) and remove the data plates from the heater case.

9-3. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

a. Clean all metal parts except the overheat thermostat in dry cleaning solvent (fed. spec. P-D-680), using a wire brush to remove deposits from the heat exchanger and burner head. If necessary, use compressed air to dry out solvent from the inside of the heat exchanger before reinstalling it in the heater.

WARNING

The heat exchanger confines the combustion gases and directs them to the exhaust pipe. It must be air tight to prevent harmful combustion products from entering the heated enclosure. Any crack or hole through the exchanger walls requires exchanger replacement.

b. Inspect the heat exchanger and its exhaust pipe for cracks, breaks, holes, excessive corrosion, and other damage. Replace a damaged heat exchanger.

c. Inspect the exchanger housing for distortion, corrosion, and other damage. Small dents or holes in the housing may be repaired as necessary, but if the blower, burner head, or heat exchanger does not seat properly on the housing, you must replace the housing.

d. Inspect the burner head for cracks, breaks, holes, and distortion. Check that the threads in the igniter and glow plug mounting holes are not damaged. Replace a damaged burner head.

e. Discard and replace the gaskets (4, 13, and 23, fig. 9-3). The exhaust washer (14) may be reused if it is not distorted, compressed, or damaged.

9-4. Installation.

a. Install the heat exchanger and burner head in the heater case in the reverse order of the index numbers in figure 9-3.

b. Install the thermocouple in the heat exchanger using a new grommet (11, fig. 9-2). Install the glow plug, igniter, and combustion air hose in the reverse order of the index numbers in figure 9-2.

c. Install the carburetor on the burner head in the reverse order of the index numbers in figure 9-1.

d. Connect the exhaust piping, making sure all joints are tight. Install the cover panels and warm air louver.

e. Connect the power and thermostat plugs, and turn on the fuel supply. Test the heater for proper operation.

CHAPTER 10
REPAIR OF BLOWER ASSEMBLY

10-1. Description.

The blower assembly consists of a 28 volt motor and two impeller assemblies. The dual combustion air impellers, located at the rear of the motor, provide air under slight pressure for combustion only. Combustion air is ducted through the combustion air hose to the burner head. Ventilation air is circulated around the outside of the heat exchanger by the ventilation air fan. This heated air passes through the warm air louver to heat the enclosure.

10-2. Removal and Disassembly.

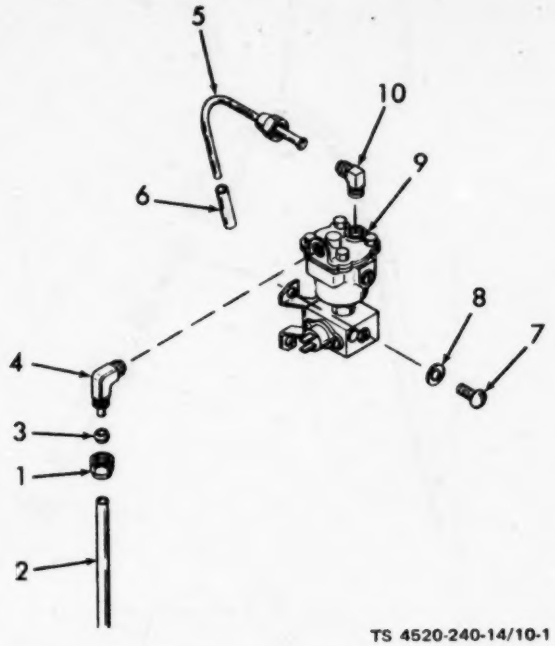
WARNING

The ignition system of this space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

a. Disconnect the power and thermostat plugs. Disconnect the fuel supply and the exhaust piping. Remove the top and side cover panels and warm air louver.

b. Disconnect the fuel preheat thermostat leads and the fuel solenoid leads. Disconnect the compression nut (1, fig. 10-1) of fuel tube (2) at the elbow (4) in the carburetor inlet. Disconnect the overflow tube (5) from the elbow (10) on the top of the carburetor (9). Remove the overflow tube and tube (6).

c. Remove the four screws (7) and lock washers (8) securing the carburetor to the burner head and remove the carburetor.

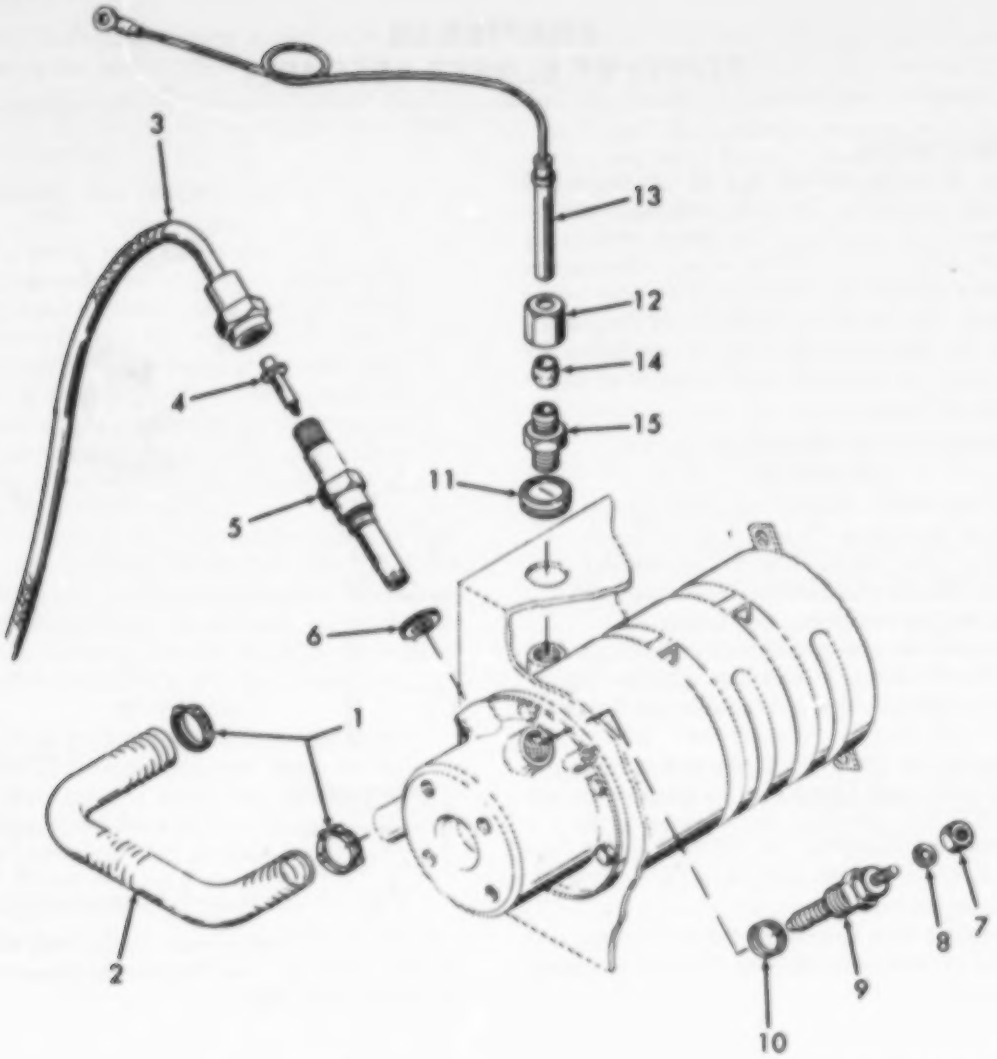


TS 4520-240-14/10-1

1. Compression nut
2. Fuel tube
3. Compression sleeve
4. Elbow
5. Overflow tube
6. Tube
7. Screw
8. Lock washer
9. Carburetor
10. Elbow

Figure 10-1. Carburetor installation, exploded view.

d. Loosen the hose clamps (1, fig. 10-2) and remove the combustion air hose (2) from the blower outlet and the burner head inlet.



1. Hose clamp
2. Combustion air hose
3. Ignition cable
4. Waterproof connector
5. Igniter
6. Gasket
7. Nut
8. Lock washer
9. Glow plug
10. Gasket
11. Grommet
12. Compression nut
13. Thermocouple
14. Compression sleeve
15. Adapter

Figure 10-2. Burner head components, exploded view.

e. Unscrew the nut on the ignition cable (3) and remove the cable and waterproof connector (4). Unscrew the igniter (5) and remove the igniter and gasket (6) from the burner head.

f. Remove the nut (7) and lock washer (8) and disconnect the blue lead from glow plug (9). Unscrew and remove the glow plug and the gasket (10) from the burner head.

g. Disengage the grommet from the hole in the heat exchanger housing. Unscrew the compression nut (12) on the thermocouple (13) and remove the assembled compression sleeve (14), compression nut, and thermocouple from the heat exchanger.

h. Use an Allen screw screwdriver to remo screws (1, fig. 10-3) and lock washers (2) securi burner head (3) to the heat exchanger housin Remove the burner head and gasket (4).

i. Remove the overheat thermostat. Remove t (5), lock washers (6 and 8), and screw (7) securi bracket (9) to the heat exchanger (22); remo bracket.

j. Remove the four screws (10) and lock washe securing the exhaust connection (12) to the heate Remove the exhaust connection, gasket (13), a haust washer (14).

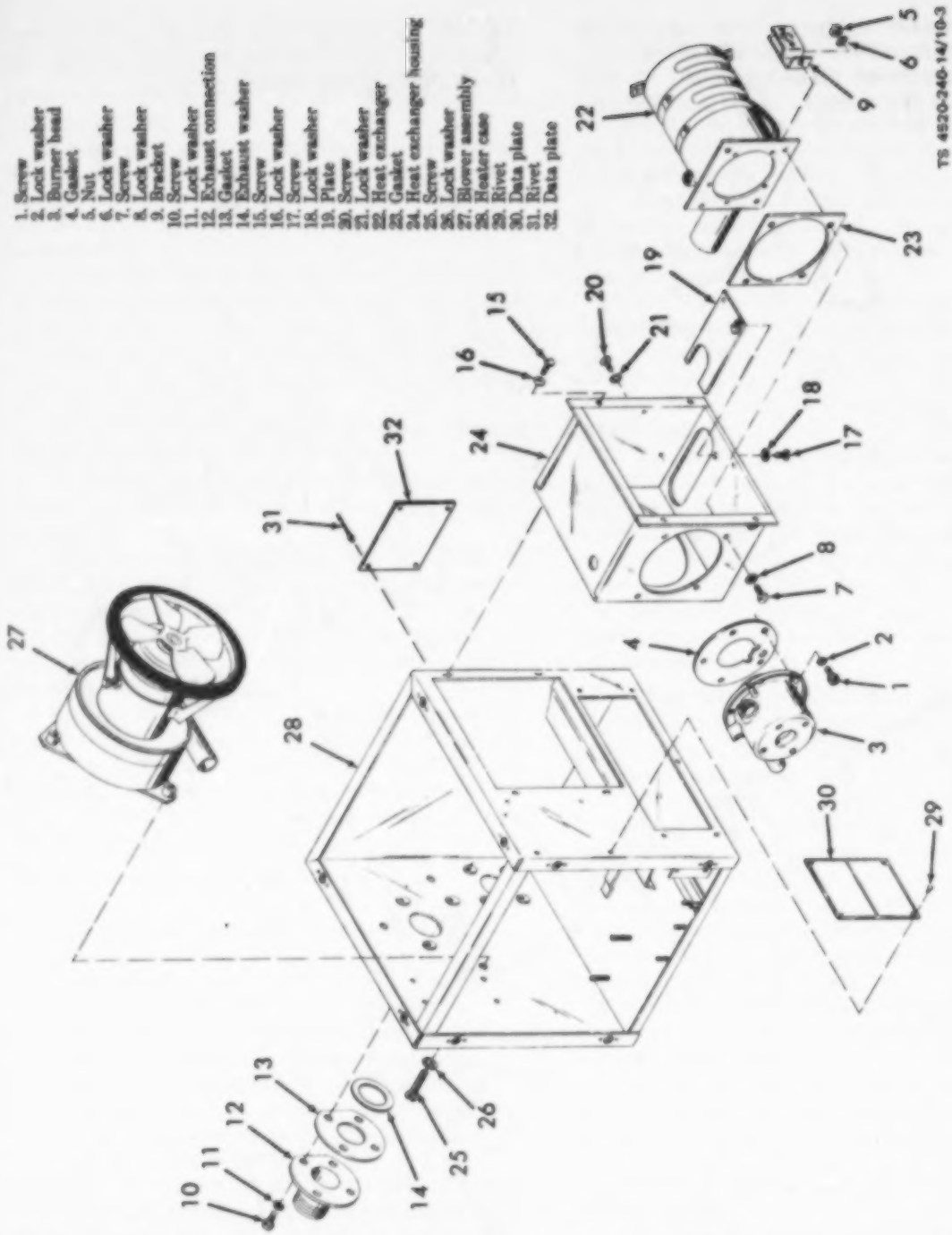


Figure 10-3. Burner head, heat exchanger, and blower installation, exploded view.

k. Remove the four screws (15) and lock washers (16) securing the heat exchanger housing (24) to the heater case (28). Pull out the assembled housing and heat exchanger to remove them from the case.

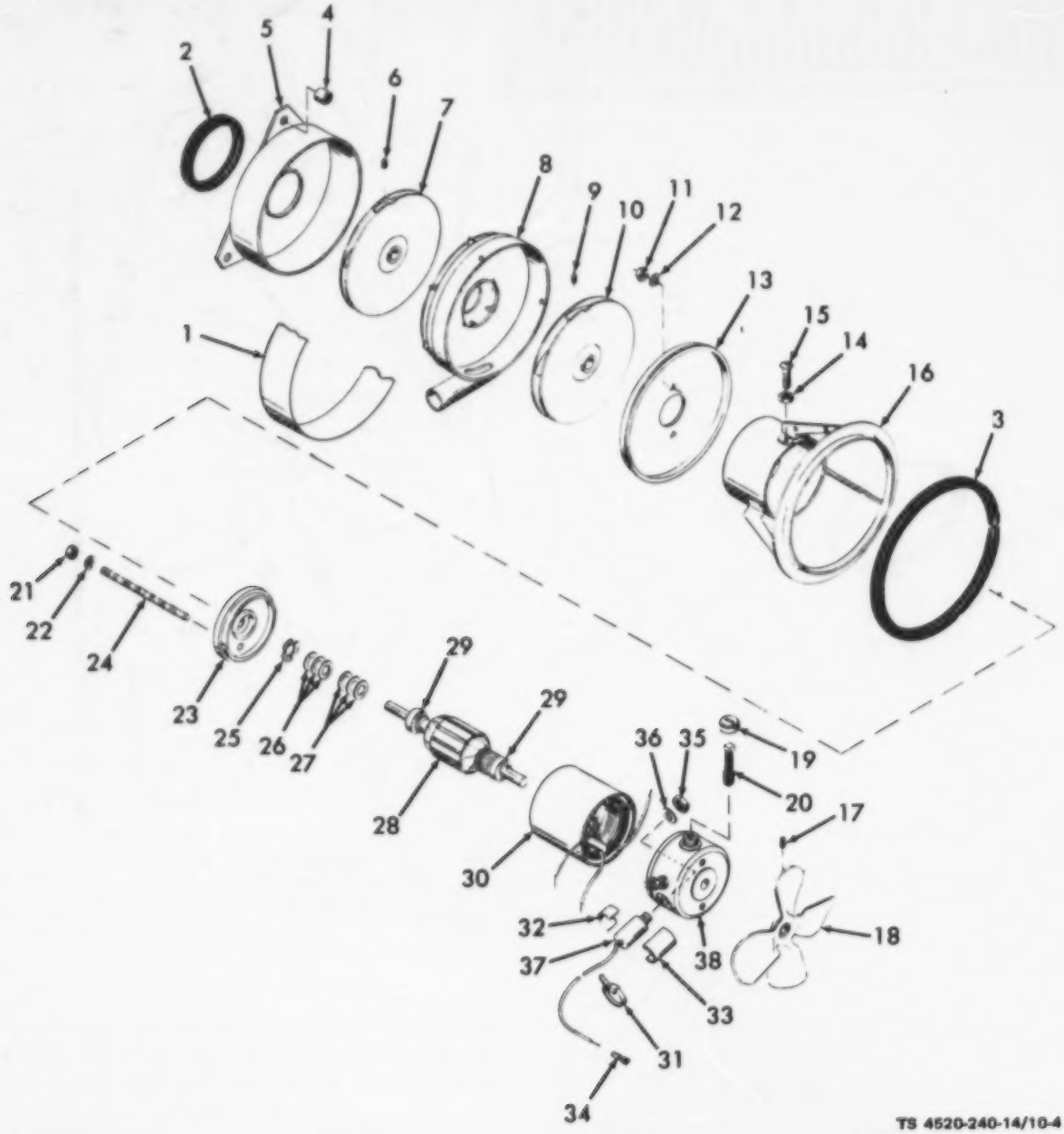
l. Remove the screw (17) and lock washer (18) from the underside of the heat exchanger housing (24), and remove the plate (19). Remove the five screws (20) and lock washers (21) securing the heat exchanger (22) to its housing. Pull the heat exchanger up and out to remove it, and remove the gasket (23).

m. If the data plates (30 and 32) are damaged, drill out the rivets (29 and 31) and remove the data plates from the heater case.

n. Disconnect the gray motor lead at the plug-in connector, and disconnect the white-black lead at the motor ground terminal. Remove the three screws (25)

and lock washers (26) securing the blower assembly (27) to the heater case (28). Remove the blower assembly.

o. Remove and discard the sealing tape (1, fig. 10-4). Use a file or punch to mark the blower housing (5), fan and tube (8), and back plate (13) to indicate correct alignment of these parts for reassembly. Remove the shroud gasket (3) and housing gasket (2).



1. Sealing tape
2. Housing gasket
3. Shroud gasket
4. Shock mount
5. Blower housing
6. Setscrew
7. Impeller
8. Fan and tube
9. Setscrew
10. Impeller
11. Nut
12. Lock washer
13. Back plate
14. Nut
15. Screw
16. Motor mount
17. Setscrew
18. Fan
19. Brush cap
20. Brush
21. Nut
22. Lock washer
23. End bell
24. Stud
25. Spring washer
26. Shim
27. Shim
28. Armature
29. Bearing
30. Stator
31. Plastic tie
32. Tape
33. Insualtor
34. Terminal and lead
35. Nut
36. Lock washer
37. Suppression capacitor
38. Commutator end bell

Figure 10-4. Blower assembly, exploded view.

p. Remove the shock mounts (4) from the blower housing (5), and pull off the blower housing to remove it. Loosen the setscrew (6) in the outer impeller (7), and remove the impeller from the motor shaft. Pull off the fan and tube (8).

q. Loosen the setscrew (9) securing the inner impeller (10) to the motor shaft, and remove the impeller. Remove the two nuts (11) and lock washers (12) securing the back plate (13) to the motor; and remove the back plate.

r. Loosen the nuts (14) and back out the screws (15) securing the motor assembly to the motor mount (16). Slide out the motor to remove it.

s. Loosen the setscrew (17) securing the fan (18) to the motor shaft, and remove the fan. Remove the brush caps (19) and brushes (20).

t. If the suppression capacitor (37) or the motor is faulty, disassemble the motor as follows:

(1) Remove the nuts (21) and lock washers (22) that secure the end bell (23) to the motor assembly; remove the end bell.

(2) Remove the spring washer (25) and shims (26 and 27), and retain them for reassembly. Pull the armature (28) from the stator (30).

(3) Separate the stator (30) from the commutator end bell (38) to provide access to the capacitor mounting hardware.

(4) Slide the plastic tie (31) from the capacitor to release the lead. Remove the tape (32) and insulator (33) from the suppression capacitor (37). Unsolder the electrical lead from the capacitor terminal inside the motor. Remove the nut (35) and lock washer (36), and remove the capacitor (37) from the end bell.

10-3. Cleaning and Inspection.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C).

a. Wipe the exterior of the motor assembly with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Prevent solvent from entering the motor. Clean the motor stator and armature using clean, dry, low pressure (30 psi maximum) compressed air to blow out dust and dirt. Wipe off any grease with a cloth dampened with solvent.

b. Clean metal parts in dry cleaning solvent and allow to dry thoroughly before reassembly.

c. Inspect the impellers and the fan for bent or broken blades or other damage. Replace damaged parts.

d. Inspect the blower housing, fan and tube, back plate, and motor mount for distortion, broken welds, and other damage. Replace defective parts.

e. Remove and inspect the motor brushes for cracks, chips, wear, or scoring. Replace brushes if damaged or if they are worn to less than 5/16 inch.

f. Inspect the condition of the motor commutator. Replace the motor if the commutator is scored or badly burned. Light scoring of the commutator can be cleaned up using fine sandpaper.

g. Visually inspect the motor armature and stator for signs of overheating or other damage. Inspect the bearings for wear and scoring. Replace defective motor parts.

h. Inspect the suppression capacitor for burned or broken insulation or other damage. If a capacitance tester is available, test the capacitor. Capacitance should be 0.47 microfarad. If a capacitance tester is not available, test the capacitor for continuity with an ohmmeter. Replace the suppression capacitor if the ohmmeter indicates that it is shorted, or if the capacitance tester indicates it is defective.

i. Discard and replace the sealing tape (1) and gaskets (2 and 3). Replace the shock mounts (4) if they are worn or damaged.

10-4. Reassembly and Installation.

a. Reassemble the motor and blower assembly in the reverse order of the index numbers in figure 10-4. Be sure to use new gaskets.

b. When reassembling, check that impellers (7 and 10) and fan (18) are positioned on the motor shaft to prevent scraping or binding against related parts.

c. Line up the alignment marks on the back plate (13), fan and tube (8), and blower housing (5) before sealing the assembled blower with tape (1).

d. Use rosin-core solder when soldering the lead to the suppression capacitor (37).

e. Install the blower assembly in the heater case as shown in figure 10-3. Secure with attaching screws (25) and lock washers (26).

f. Connect the white-black lead to the ground terminal of the motor. Connect the gray lead to the plug-in connector as shown in the wiring diagram (fig. 1-4). Connect the motor ground strap to the fuel pump mounting stud, and secure it with the attaching nut and lock washer.

g. Install the heat exchanger and burner head in the heater case in the reverse order of the index numbers in figure 10-3.

h. Install the thermocouple in the heat exchanger using a new grommet (11, fig. 10-2). Install the glow plug, igniter, and combustion air hose in the reverse order of the index numbers in figure 10-2.

i. Install the carburetor in the burner head in the reverse order of the index numbers in figure 10-1.

j. Connect the exhaust piping, making sure all joints are tight.

k. Connect the power and thermostat plugs, and turn on the fuel supply. Test the heater for proper operation.

APPENDIX A
REFERENCES

A-1 Fire Protection and Safety

TM 5-4200-200-10	Hand Portable Fire Extinguishers for Army Users
TB MED 269	Carbon Monoxide: Symptoms, Etiology, Treatment and Prevention of Overexposure

A-2 Lubrication

C 9100IL	Identification List for Fuels, Lubricants, Oils, and Waxes

A-3 Painting

TM 9-213	Painting Instruction for Field Use
TB 750-260	Painting Instructions for Operator and Organizational Maintenance Personnel

A-4 Maintenance

TM 5-4520-240-24P	Organizational, Direct and General Support Repair Parts and Special Tools List
TM 11-483	Radio Interference Suppression
DA PAM 738-750	The Army Maintenance Management System
AR 750-1	Army Materiel Maintenance Concepts and Policies

A-5 Shipment and Storage

SB 740-4520-97-E01	Storage Serviceability Standard for Heaters
SB 38-100	Army Preservation, Packing, and Marking Materials, Supplies and Equipment
TM 38-230-1	Preservation and Packing of Military Equipment
TM 740-90-1	Administrative Storage of Equipment

A-6 Demolition

TM 750-244-3	Destruction of Material to Prevent Enemy Use

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.

B-2. Explanation of Columns in Section II.

a. Column (1), Group Number. Column (1) lists group numbers to identify related components, assemblies, sub-assemblies, and modules with their next higher assembly. The applicable groups are listed in the MAC in disassembly sequence beginning with the first group removed.

b. Column (2), Component/Assembly. This column contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized.

c. Column (3), Maintenance Functions. This column lists the functions to be performed on the item listed in Column 2. The maintenance functions are defined as follows:

(1) *Inspect.* To determine serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

(2) *Test.* To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

(3) *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminated), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

(4) *Adjust.* To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to be specified parameters.

(5) *Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.

(6) *Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

(7) *Install.* The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

(8) *Replace.* The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

(9) *Repair.* The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

(10) *Overhaul.* That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like-new condition.

(11) *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

d. Column (4), Maintenance Category. This column is made up of sub-columns for each category of maintenance. Work time figures are listed in these sub-columns for the lowest level of maintenance authorized to perform the function listed in Column 3. These figures indicate the average active time required to perform the maintenance function at the indicated category of maintenance under typical field operating conditions.

e. Column (5), Tools and Equipment. This column is provided for referencing by code, the common tool sets (not individual tools) special tools, test and support

equipment required to perform the designated function.

B-3. Explanation of Columns in Section III.

a. Column (1), Reference Code. This column consists of an arabic number listed in sequence from Column 5 of Section II. The number references the common tool sets, special tools and test equipment requirements.

b. Column (2), Maintenance Category. This column shows the lowest category of maintenance authorized to use the special tools or test equipment.

c. Column (3), Nomenclature. This column lists the name or identification of the common tool sets, special tools or test equipment.

d. Column (4), National/Nato Stock No. (NSN). This column is provided for the NSN of common tool sets, special tools and test equipment listed in the Nomenclature column.

e. Column (5), Tool Number. This column lists the manufacturer's code and part number of tools and test equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1)	(2)	(3)	(4)					(5)
Group number	Component/assembly	Maintenance function	Maintenance category* C	O	F	H	D	Tools and equipment
01	HEATER ASSEMBLY	Install				0.5		
		Service	0.2					
		Replace		0.5				
02	HOUSING ASSEMBLY							
	Cover Panels	Inspect		0.1				
		Replace		0.1				
		Service		0.1				
0202	Housing	Inspect		0.1				
		Service		0.1				
0203	Control Panel	Inspect		0.1				
		Test			0.5			
		Replace			0.5			
		Repair			1.0			
	Switch, ON-OFF	Test		0.5				
		Replace		0.5				
	Reset, Time Delay	Test			0.5			
		Replace			1.0			
	Receptacle, POWER and THERMO	Inspect		0.5				
		Replace			1.0			
0204	Data Plates	Inspect		0.2				
	Instruction	Replace			0.5			
	Identification							
	Schematic Wiring							
0205	Louver	Inspect		0.2				
		Replace		0.2				
03	FUEL SYSTEM							
0301	Fuel Strainer	Service		0.3				
		Replace		0.3				
0302	Fuel Pump	Service		0.3				
		Replace		0.3				
0303	Fuel Lines	Inspect		0.2				
		Replace		0.2				
0304	Carburetor Assembly	Service		0.5				
		Replace		0.5				
		Adjust		0.3				
0305	Solenoid Valve	Test		0.3				
		Replace		0.3				
04	ELECTRICAL							
0401	Ignition Power Supply							
	Transformer	Test			0.5			
		Replace			0.5			
	Resistor	Test			0.5			
		Replace			0.5			
	Diode	Test			0.5			
		Replace			0.5			

* SUBCOLUMNS ARE AS FOLLOWS: C - OPERATOR/CREW; O - ORGANIZATIONAL; F - DIRECT SUPPORT; H - GENERAL SUPPORT; D - DEPOT

** INDICATES WT/MH REQUIRED

(1) Group number	(2) Component/assembly	(3) Maintenance function	(4) Maintenance category* C	O	F	H	D	(5) Tools and equipment
	Filter, Interference	Test			0.5			
		Replace			0.5			
0402	Wiring Harness	Inspect			0.5			
		Repair			0.5			
		Replace			1.0			
0403	Fuses	Inspect		0.1				
		Replace		0.1				
0404	Thermostat, Room	Adjust	0.1					
		Test		0.5				
		Replace		0.5				
0405	Thermocouple	Inspect		0.2				
		Replace		0.2				
0406	Relay, Thermocouple	Test			0.5			
		Replace			0.5			
0407	Thermostats, Overheat and	Test			0.5			
	Preheat	Replace			0.5			
05	BURNER ASSEMBLY							
0501	Burner Head	Inspect			0.5			
		Service			0.5			
		Replace			0.5			
0502	Igniter	Inspect		0.2				
		Service		0.2				
		Replace		0.2				
0503	Glow Plug	Inspect		0.2				
		Service		0.2				
		Replace		0.2				
0504	Ignition Cable	Inspect		0.2				
06	HEAT EXCHANGER	Inspect			0.5			
		Service			0.5			
		Replace			0.5			
07	BLOWER ASSEMBLY	Inspect			0.5			
		Replace			0.5			
		Repair			1.0			
0701	Motor, Blower	Inspect			0.5			
		Test			0.5			
0702	Capacitor, Suppression	Test			0.5			
		Replace			0.5			
0703	Brushes	Inspect		0.3				
		Replace		0.3				
0704	Armature	Inspect			0.5			
		Service			0.5			
		Test			0.5			
0705	Fans	Inspect			0.5			

* SUBCOLUMNS ARE AS FOLLOWS: C - OPERATOR/CREW; O - ORGANIZATIONAL; F - DIRECT SUPPORT; H - GENERAL SUPPORT; D - DEPOT

** INDICATES WT/MH REQUIRED

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference code	(2) Maintenance category	(3) Nomenclature	(4) National stock number (NSN)	(5) Tool number
		Soldering Gun Kit, 3 Tips, Separate Heat Ranges	3439-00-930-1638	
		Tool Kit, Service, Refrigeration Unit	5180-00-596-1474	

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DATE 16 DEC 74

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TM5-6115-200-20 AND P	1 APR 72	GENERATOR SET 10 KW NSN 6115-00-231-7296

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN

SAMPLE

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REVERSE OF DA FORM 2028-2 (TEST)

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 diciliters = 33.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	centimeters	inches	.394
feet	meters	.305	meters	feet	3.280
yards	meters	.914	meters	yards	1.094
miles	kilometers	1.609	kilometers	miles	.621
square inches	square centimeters	6.451	square centimeters	square inches	.155
square feet	square meters	.093	square meters	square feet	10.764
square yards	square meters	.836	square meters	square yards	1.196
square miles	square kilometers	2.590	square kilometers	square miles	.386
acres	square hectometers	.405	square hectometers	acres	2.471
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
cubic yards	cubic meters	.765	cubic meters	cubic yards	1.308
fluid ounces	milliliters	29.573	milliliters	fluid ounces	.034
pints	liters	.473	liters	pints	2.113
quarts	liters	.946	liters	quarts	1.057
gallons	liters	3.785	liters	gallons	.264
ounces	grams	28.349	grams	ounces	.035
pounds	kilograms	.454	kilograms	pounds	2.205
short tons	metric tons	.907	metric tons	short tons	1.102

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